# draft environmental impact statement

volume II - affected environment • environmental consequences

april 1985



# LAKE MEAD

NATIONAL RECREATION AREA / ARIZONA - NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

# DRAFT ENVIRONMENTAL IMPACT STATEMENT
# VOLUME II - AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

## LAKE MEAD NATIONAL RECREATION AREA
Mohave County, Arizona, and Clark County, Nevada

# PREFACE

This document is divided into two volumes. Volume I describes the draft general management plan and alternatives. The issues addressed include increasing visitation, congestion and user conflicts, flood mitigation, management zoning, lands suitable for wilderness, illegal use of vehicles off approved roads, resources management, boating carrying capacity, information/interpretation, land protection, trailer and cabin site policy, road problems, Las Vegas Wetlands Park proposal, and NPS and concession development proposals. Volume II describes the affected environment and the environmental consequences of implementing the alternatives and proposed action. A discussion of consultation and coordination, the appendixes, bibliography, and list of document preparers are also included.

# AFFECTED ENVIRONMENT

Lake Mead National Recreation is so large and complex that it has been divided into several geographic planning zones for ease of discussion. A brief description of each zone follows. The zones are mapped in the "Summary" section in volume I.

## Katherine Zone

The Katherine Landing development is the only developed access point within the Katherine zone. This development is a large and highly popular resort area for southern California and Arizona boaters and waterskiers during the summer months; the area also serves local residents year-round as a day use swimming and boat launching area. It is the major houseboat rental center for Lake Mohave. The majority of visitor use for the zone is in the coves immediately surrounding the developed area. Most of these coves are accessible by boat only, and other coves in the zone are accessible only by four-wheel-drive vehicle or by boat and are less used. The flood hazard is severe throughout the main development and in Telephone Cove, and it is considered the third most hazardous developed area in the recreation area for potential flooding.

## Cottonwood Zone

A major portion of this zone is Cottonwood Basin, which is the only large basin on Lake Mohave. Access to this area is through Cottonwood Cove, a popular resort during the summer months for water-skiers and boaters. During the fall, winter, and spring the area primarily serves fishermen from nearby communities in Arizona and Nevada. A great variety of watercraft (ski boats, hot boats, fishing boats, and houseboats) uses the marina and day facilities. This area has the second greatest flood hazard of any developed area, with most development being vulnerable.

## Willow Beach Zone

The major attraction in this zone is the cold waters of northern Lake Mohave which provide excellent trout fishing. The only developed access point in this zone is a small concession operation that functions primarily as a fishing resort. Overnight accommodations for visitors are currently limited to a motel and short-term trailer sites; the campground has been closed because of flash-flood hazards. This area has the most severe flood hazard of any developed area in the recreation area.

## Boulder Basin Zone

The majority of visitors to this zone are day users; overnight accommodations are limited to one small motel at Boulder Beach and four

campgrounds. Most year-round day use is from the Las Vegas metropolitan area, less than 25 miles away. Southern Californians make up a large percentage of use in the summer months, and many of the people attracted to Las Vegas from all parts of the country contribute to day use activities. The main activities are waterskiing, boating, swimming, and fishing. The following developed areas in this zone provide and service day use activities.

Boulder Beach is the largest and most heavily visited development in the recreation area; most of the area is susceptible to shallow sheet flooding across the broad alluvial fan.

Las Vegas Wash is the closest area to Las Vegas and therefore attracts a large number of day use visitors; a severe flood hazard exists only for the boat storage area and launch ramp.

Callville Bay has the largest marina to service boatowners from Las Vegas; it is one of the few developed areas without flood hazard.

Some of the most popular coves within this zone are accessible by boat only. Boats leaving any of the marinas within the zone can reach these coves. Some coves are also accessible by unimproved dirt roads.

Echo Bay Zone

This underutilized access point to the Overton Arm provides a full range of services and facilities for day and overnight use; most visitors are fishermen and houseboaters from Las Vegas and southern California. Despite the well maintained modern facilities, the area has not been heavily used because of its distance from southern California and Las Vegas. However, in response to crowding at developed areas in Boulder Basin, more visitors are seeking less crowded conditions at more distant areas. This trend can be expected to continue as congestion mounts to the south and as the harbor and land-based facilities at Echo Bay are discovered by more people. The area is not threatened by flood hazard.

Stewarts Point provides an additional lake access opportunity within the Echo Bay zone. The access road leads to vacation cabins that dot the bluffs and an unimproved launch ramp.

In addition to the attractive lake areas available within the Echo Bay zone, several features apart from the lake and accessible by the Northshore Road enhance the zone's possibilities for visitor use. Rogers Spring and Bluepoint Spring provide a unique diversion for visitors traveling the highway north or south. Warm water bubbles up from these underground hot springs, creating an inviting oasis, complete with large trees. Redstone picnic area features large sandstone rock outcroppings that rise from the ground in dramatic formations. Opportunities for exploration and discovery are abundant throughout the geologically varied area.

## Overton Beach Zone

A small, uncrowded, developed area provides primary access to the zone. The overnight accommodations are limited to primitive camping areas. Small, nearby communities contribute to visitation and use, but the majority of visitors are from major cities to the north and south. Fall and winter brings retired couples who are escaping cold weather and spring brings local Nevadans for skiing, boating, and fishing. The undeveloped camping area is the only part of the area in a flood-hazard zone.

## Virgin/Temple Zone

This zone has great potential for growth and is currently underused. Temple Bar serves as the last concession area (or fuel stop) for boaters traveling east on Lake Mead toward the Grand Canyon. Fishing is the most popular activity; overnight accommodations include a motel, short-term trailer sites, and a 153-site campground. Temple Bar is remote compared to other developments and provides convenient access to less congested portions of the lake. It has the fourth greatest flood hazard risk of any developed area, with most development being vulnerable.

## Gregg Basin/Grand Wash Zone

This zone is an undeveloped scenic area of the lake; access is limited to one paved launch ramp at South Cove and one unpaved launch ramp at Pearce Ferry, two improved roads, and several unimproved dirt roads.

Visitors must come prepared because the closest services are at Temple Bar about 15-20 miles away by water. The area is isolated and visitation is low, originating from a variety of locations. Use is primarily overnight beach camping; major activities are boating, skiing, and fishing. Pearce Ferry is a takeout point for river runners in the Grand Canyon and a gateway for trips into the canyon. A flash-flood hazard exists at Pearce Ferry and in many of the undeveloped coves in the zone.

## Shivwits Plateau Zone

This area is the most isolated and least visited in the recreation area. It is actively grazed and visitors are generally limited to hunters, yet it affords some of the most spectacular views of the canyon rim country. Access is over a county dirt road. The road within the recreation area is rough, slow, and suitable for four-wheel-drive vehicles only. Due to a higher elevation (6,400 feet), the region is cooler, has more precipitation, and supports pinyon/juniper and ponderosa pine forests. Therefore, it also contains a wider variety of wildlife, including the only concentration of mule deer to be found in the recreation area. Big game hunting is a favorite recreational pursuit and probably accounts for the majority of visitation to this area (2,000 visitors per year). Additional recreational

activities include nature study, camping with a vehicle, exploring with four-wheel-drive vehicles, and hiking the superlative rim country. Kelly Point, Twin Point, and other points along the rim permit spectacular views of the Grand Canyon; there is no flood hazard in use areas.

## ENVIRONMENTAL CONSTRAINTS

Environmental constraints restrict development and use of certain areas within the recreation area. These constraints include climate, unstable soils, vegetation/wildlife, floodplains, and cultural resources.

The climate of the park is typical of the arid desert. Temperature extremes are common (32° to 110°F or 0° to 35°C), and temperatures can vary greatly within a single day. Precipitation averages 3 to 5 inches annually. Snow falls in the highest elevations of the park on the Shivwits Plateau. Late summer and early fall thunderstorms create flash floods in both developed and undeveloped visitor use areas.

Soils within the recreation area are generally shallow, friable, wind-deposited, or alluvial materials that are very susceptible to wind and water erosion. Erosive forces cause significant, sometimes dramatic, and long-lasting changes in physiography. Evaporation rates are much greater than precipitation and this creates extremely low soil moisture conditions throughout the year, which severely restricts plant growth. Modification by use or development causes loss of soils; this soil damage is slow to heal because of sparse plant growth. Unstable gypsum soils occur in several areas along the Overton Beach access road and in the Detrital Bay area.

Vegetation in general does not present any constraints except that once it is disturbed, the recovery period is usually long. The exotic species, tamarisk, which invades wet areas, often becomes so thick that it limits usable beach space and drys up wildlife water sources. There are several species of plants (see significant natural features under natural environment in "Affected Environment" section) that are significant because, for example, they reach their northern most limits within the park. There are no plant species, however, that are officially listed as threatened or endangered by the U.S. Fish and Wildlife Service. Several species are being considered for listing, many of which are already listed by the states of Arizona and Nevada or are species of concern. It is NPS policy to treat such plants as if they were officially listed.

The bonytail chub, Gila elegans, and the bald eagle, Haliaeetus leucocephalus, are the only two animal species found in the recreation area which are officially listed as threatened or endangered by the U.S. Fish and Wildlife Service. As with plants, there are several animal species that would potentially be listed or are listed by the two states, such as the gila monster and desert tortoise. Again, they would be treated by the Park Service as if they were officially listed. Desert bighorn sheep inhabit many areas within the recreation area and their habitat requirements are quite crucial. Some herds, for example, the River Mountain herd, are among the most productive in the region.

Because of the requirements of Executive Order 11988, "Floodplain Management" 3 CFR 121 (Supp. 1977), Executive Order 11990, "Protection of Wetlands" 3 CFR 121 (Supp. 1977), and the final NPS procedures for implementing these orders, certain restrictions must be placed on use in the recreation area. Mapping of the 100-year and the probable maximum

floodplains was performed by the U.S. Army Corps of Engineers, U.S. Geological Survey, National Park Service, and private consulting firms for all developed areas, several existing and proposed improved access points, and many popular undeveloped visitor use areas. Once the plan is implemented, all the existing or proposed developments that now occur in hazardous flash-flood areas would be designed to protect the structures and provide for human safety.

Fluctuating reservoir levels are also major constraints. Originally the Park Service, after consulting with the Bureau of Reclamation, considered the maximum reservoir level to be 1,221 feet above sea level for Lake Mead. However, because of abnormally high snowpack in the Rocky Mountains in 1983, the reservoir level reached 1,226 feet. Damage to facilities occurred in the 1,221-foot to 1,226-foot zone. Accordingly, the Park Service now considers maximum high water to be 1,230 feet above sea level. Any facilities that could be damaged by water would not be allowed below that level. Daily fluctuations on Lake Mohave are more than those on Lake Mead; however, the annual fluctuations on Lake Mohave are much less. No facilities would be built below the 650-foot contour, which is considered to be the high waterline for Lake Mohave.

Archeological and historic resources of significance have been nominated for inclusion to the National Register of Historic Places. Adverse effects on these significant archeological and historic resources would be mitigated or avoided.

# NATURAL ENVIRONMENT

## CLIMATE

The variety of topographical features and elevation differences within the Lake Mead region create numerous microclimates. The lower elevations along the Colorado River and the broad valleys between mountain ranges have an arid climate typical of the Mohave Desert. Precipitation is low, averaging only 3 to 5 inches per year. Humidity is also low and averages about 28 percent. Winters are mild, with daily temperatures in January ranging between 32°F and 55°F on many days. In summer an average July maximum temperature reaches nearly 105°F. Evaporation rates are extremely high and exceed 80 inches per year at the surface of Lake Mead.

Most of the precipitation occurs during the winter months and during July through September. There is a period every late summer when warm, moist, tropical air dominates weather conditions in this area, creating higher than average humidity and scattered thundershowers that cause flash-flooding with rapid runoff and severe erosion. Washes that have been dry for the rest of the year can flow without warning. At Lake Mead the greatest hazard to life and property occurs where developed areas were built in flash-flood washes before the danger was fully understood. Virtually every wash in the recreation area can be the path of a flash flood from time to time. Precipitation during the winter is usually from regional storms of low intensity and longer duration. Less than 2 inches of snow per year falls at lower elevations, and it only remains on the ground for a day or two.

Elevation has a marked effect on climatic conditions. Precipitation increases and temperature decreases toward the higher elevations of the area, and the climate becomes more semiarid and steppe-like. Above elevations of about 5,000 feet, the temperature averages approximately 10°F cooler than the lowlands. Summer temperatures on the Shivwits Plateau have average highs in the 90s and lows in the 60s. Winter temperatures may drop as low as -10°F. Snow may fall at any time between October and April, with total yearly amounts averaging between 18 and 33 inches above elevations of 5,000 feet.

Clear weather is the hallmark of the Lake Mead region. There are few overcast, rainy days during the year. The area along the lower Colorado River, south of Willow Beach, is one of four places on earth having more than 4,000 hours of sunshine each year.

## GEOLOGY

Lake Mead National Recreation Area contains approximately 2,350 square miles of biologically and geologically diversified land and water environments. The Grand Wash Cliffs mark the boundary between the Colorado Plateau province of the eastern portion of the recreation area and the Basin and Range province of the central and western portions of the recreation area.

The Basin and Range province is characterized by generally north-south trending mountain ranges separated by broad, shallow valleys. Many of these intervening valleys have no exterior drainage and form enclosed basins. The mountains are dissected by deep ravines that open into broad alluvial fans. Commonly, adjoining fans coalesce and form a continuous alluvial apron along the base of the mountains. These slopes extend outward into the valleys where they merge with the valley floor, or extend across the valley and join opposing slopes that form an alluvial divide. The valley floors are usually nearly level and often contain one or more playas, or dry lakes, where silt, clay, evaporites, and weakly cemented gravels have been deposited. In the tilted, fault-block mountains, the age of strata ranges from Precambrian to Tertiary, while the sediments in the intervening structural basins are all younger than the Mesozoic and consist chiefly of late Tertiary and Quaternary deposits.

The portion of the Colorado Plateau province within the recreation area lies east of the Grand Wash Cliffs and north of the Grand Canyon of the Colorado River. It encompasses the southern portion of the Shivwits Plateau, the extreme southwestern portion of the Uinkaret Plateau, and a small portion of the inner-canyon platform known as the Esplanade.

Most of the upland plateau is a gently rolling but dissected tableland. A number of lava-capped buttes rise above the general landscape, culminating in 7 million-year-old Mount Dellenbaugh, which at an elevation of 6,990 feet is the highest point in the recreation area. The southern edge of the plateau drops away precipitously toward the Colorado River.

The sedimentary rock column includes strata ranging in age from Lower Cambrian to Middle Triassic and overlies a basement complex of Precambrian granite and schist. The sedimentary formations are nearly horizontal and generally have a dip of less than 5° to the east and northeast.

Most of the faults in this section of the recreation area are high-angle and dip-slip, with some having a scissors movement. Structurally and topographically, this portion of the Colorado Plateau contrasts sharply with the deep structural basins, block-faulted ranges, and tilted blocks of strata that are characteristic of the Basin and Range province to the west.

This portion of the Colorado Plateau provides a classic example of landscape development in nearly horizontal sedimentary rocks with different resistance to erosion under semiarid conditions. In general the landscape is composed of five classes of features: steep to vertical-walled canyons developed in resistant strata; beveled surfaces of the inner canyon of the Colorado River where the massive crystalline rocks of the Precambrian and lower Paleozoic carbonate strata have a more uniform resistance to erosion; stripped surfaces that are developed on a particularly resistant stratum overlain by less resistant strata, typified by the Kaibab uplands and the Esplanade; scarps, either erosional or tectonic, such as the Hurricane and Grand Wash Cliffs; and surfaces of aggradation, most notably represented by lava flows, talus, and colluvial slopes. The three broad soil associations represented in Lake Mead National Recreation Area are as follows.

Lithosols are thin, stony surface soils derived from rocky parent materials which characterize the slopes and crests of parallel desert ranges. These soils support scant growths of desert shrubs. Areas include desert ranges, such as Eldorado, Newberry, Black, River, Muddy, and Virgin mountains; the crests, rocky slopes, and upper part of some associated alluvial slopes; and steep-walled canyons.

Red desert soils are pinkish, reddish, and brownish-gray soils, which are commonly only slightly leached, rich in lime and mineral plant nutrients. They are derived from alluvial outwash from a great variety of rocks in the mountain ranges (metamorphic, granitic, volcanic, sedimentary). Red desert soils include stony to gritty alluvium of fan deposits and finer basin interior deposits. These soils support creosotebush, leguminous trees, cacti, etc. Areas include desert basins, Detrital Wash, Eldorado Valley, and others.

Catron soils are dark brownish-gray to black calcareous soils with moderately high organic content. They are derived from calcareous shales, sandstones, and hard limestone bedrock. Catron soils support a pinyon/juniper grassland association of plants. Areas include the Colorado Plateau section of the recreation area in regions interrupted by outcropping ledges, abrupt cliffs, and deep stream-carved canyons.

## MINERALS

The principal source of the following information on mineral resources is in appendix G and is a study commissioned by the National Park Service in 1982 to provide an assessment of the occurrence and significance of minerals in the recreation area (O'Brien 1982). Other sources of information on mineral occurrences were also obtained from the U.S. Geological Survey (USGS), Nevada Bureau of Mines, and Arizona Bureau of Mines. The mineral resources are defined according to terminology adopted by the Deaprtment of Interior in 1974 and used by the U.S. Bureau of Mines and Geological Survey in their assessment of the nation's mineral resources.

The mineral resources of Lake Mead region are found in widely scattered areas throughout the recreation area. Although there has been a long history of mineral exploration in the area, dating from the early 1860s, mineral production has been minimal. The only recorded production within the last 25 years of leasing at Lake Mead is 60 pounds of tungsten concentrate. For ease of discussion, the mineral resources have been subdivided into metallics, nonmetallics, and energy resources.

Metallic Minerals: Gold in lode deposits has been found in several locations along the west side of Lake Mohave in the Newberry Mountains and Eldorado Mountains in Nevada and near Davis Dam in Arizona. Although several mines operated in these areas in the early 1900s, no production has occurred since 1941. Placer gold occurs in the area, but there has never been a successful placer

mine within the boundaries of the recreation area. Although high-grade deposits of gold and silver may still be found in the area, the lack of recent production makes these minerals geologically speculative in the recreation area. Low-grade manganese ores are found as lenticular pockets in the Muddy Creek formation within the recreation area; however, none of the deposits have ever been developed. Manganese is currently classified as a submarginal mineral resource in the recreation area. Molybdenum was reported in the Eldorado Mountains west of Lake Mohave, but subsequent drilling operations were abandoned. Other reports of molybdenum have not been substantiated, hence, the mineral has been classified as speculative.

Base metals such as lead, zinc, and copper have been mined at several locations, mostly outside the boundaries of Lake Mead. These minerals have generally been produced as by-products (of lesser value) of gold and silver productions. These minerals are also placed in the speculative category.

A small deposit of tungsten occurs near Iceberg Canyon within the recreation area. The deposit has been under lease for over 20 years and has produced 60 pounds of concentrate during that time.

Nonmetallic Minerals: Silica is mined outside the recreation area near Overton, Nevada, but there are no reported deposits within the recreation area. Large deposits of salt were mined near St. Thomas Wash and Overton Beach before completion of Hoover Dam but have since been inundated by the waters of Lake Mead. There are subsurface deposits of salt under Detrital and Hualapai valleys outside the recreation area in Arizona, but the need for massive amounts of water to extract the mineral may limit the possibility of using these deposits.

Energy Minerals: Oil and gas leasing has occurred within and adjacent to the recreation area since its establishment and for many years before. However no recent wells have been drilled within the recreation area and no productive fields have been defined. Recent interest in oil and gas in the area is the result of speculation on the southern trend of the overthrust belt, a productive region in northwest Utah, southwest Wyoming, and northwest Colorado which may also extend into the recreation area. In recent years, several deep wells have been drilled west of the Overton Arm, adjacent to the park boundary, but they have failed to find any promising shows of oil or gas or to confirm the existence of the overthrust belt through stratigraphic testing. Since the last of these holes were drilled in 1980, 64 leases within the recreation area have been withdrawn by their owners. Oil and gas resources thus remain only speculative in the recreation area.

Uranium occurs in a series of breccia pipes, diatremes, silica plugs, kimberlite pipes, and marrs throughout the Grand Canyon region and extending into the recreation area. Most of these geologic features have been explored for their copper, silver, and gold content.


## MINERAL LEASES

| BLM Lease # | Acres | Type | Lessee | Date Effective | Annual Rental |
|---|---|---|---|---|---|
| **NEVADA** (8 Leases) | | | | | |
| N4656 | 400 | Mineral | Gentry | 4/1/71 | $ 100 |
| N24370 | 1926 | O&G | Huffco | 8/1/82 | $1,926 |
| N24371 | 1920 | | Petrol. | | $ 1,921 |
| N24374 | 2560 | | | 10/1/82 | $2,560 |
| N30031 | 640 | O&G | IMC Expl. | 12/1/82 | 640 |
| N30034 | 1920 | | | 9/1/82 | $1,920 |
| N30035 | 1920 | | | | $1,920 |
| N35193 | 640 | O&G | Hartley | 11/1/82 | $ 640 |
| **ARIZONA** (8 Leases) | | | | | |
| A8864 | 639 | O&G | Wahl–Yee | 3/1/80 | $ 639 |
| A8873 | 1280 | | | 8/1/80 | $ 640 |
| A10896 | 643 | Mineral | Resource | 2/1/80 | $ 322 |
| A10897 | 640 | | International Partners | | $ 320 |
| A11815 | 640 | Mineral | | 4/1/82 | $ 640 |
| A14787 | 1280 | O&G | IREX Over-thrust Acreage | 4/1/81 | $1,280 |
| A17347 | 160 | Mineral | Energy Fuels | 1/1/82 | $ 80 |
| A17761 | 1279 | O&G | Kenderdine | 6/1/82 | $1,280 |

**18,487 TOTAL ACRES UNDER LEASE IN NRA** — **TOTAL $ 16,828**

11,926 acres leased in Nevada
6,561 acres leased in Arizona

## OTHER MINERAL INTERESTS

| | ACRES |
|---|---|
| Copper Mountain Mine (UNPATENTED CLAIMS) | 83 |
| PATENTED CLAIMS | 11,435 |
| NON FEDERAL SUBSURFACE MINERAL RIGHTS | 55,000 |
| STATE SCHOOL LANDS | 2,654 |
| TOTAL | 69,172 |

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# EXISTING MINING CLAIMS AND MINERAL LEASES

## LAKE MEAD NATIONAL RECREATION AREA

ARIZONA-NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

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MINERAL LEASES

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## LAKE MEAD NATIONAL RECREATION AREA

ARIZONA-NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

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> Uranium is only suspected as a companion mineral with the copper, but to date has not been proven to exist in sufficient quantities to be of economic value. Interest in uranium exploration centers around the Parashant-Whitmore Canyon area on the Shivwits Plateau where several applications for prospecting permits have been filed in the last few years. Estimates of reserves can only be inferred for the area and therefore place uranium in the speculative category (inferred refers to estimates of the quality and size of the resource which are based on geologic evidence and projections only). The USGS estimates the inferred reserves at 250 tons of uranium oxide within the Parashant-Whitmore Canyon area (USDI, NPS 1977).

The results of the mineral resources evaluation indicates that there are no minerals within the recreation areas of significant quantity or quality to affect the nation's supply of any given commodity. There are no known mineral reserves in the recreation area, and possible mineral resources are classified as geologically speculative, the lowest possible category of importance. The probability of future mineral development brought on by changes in economic and political situations is also remote because of an unfavorable mineralized environment of the recreation area.

## WILDERNESS SUITABILITY

The Wilderness Act of 1964 directed the secretary of interior to review all roadless areas within units of the national park system and to make recommendations as to the suitability or nonsuitability of each area to the president and the Congress. The act defined wilderness as

> an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean . . . an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which: (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value."

The act further stated,

> Nothing in this Act shall modify the statutory authority under which units of the national park system are created. Further, the designation of any area of any park, monument, or other unit of the national park system as a wilderness area pursuant to this Act shall in no manner lower the standards evolved for the use and preservation of such park, monument, or other unit of the national park system in accordance with the Act of

August 25, 1916, the statutory authority under which the area was created, or any other Act of Congress which might pertain to or affect such area.

Based on the above criteria, the National Park Service initiated a wilderness review of all the lands within Lake Mead National Recreation Area. This initial review was completed by the Park Service in 1974, when 409,000 acres were proposed for wilderness. In the president's transmittal to Congress, the recommendation was made to defer action on the Lake Mead proposal, pending a study of western power needs by the Bureau of Reclamation. When this study was completed, the National Park Service initiated a new wilderness review using the information provided by the Bureau of Reclamation. This review was completed in 1979 when 418,000 acres were proposed for wilderness and an additional 262,000 acres were proposed as potential wilderness additions (to be designated wilderness when nonqualifying conditions no longer existed). Revisions to this proposal and the Draft Environmental Statement were being prepared based on public comment when the GMP was initiated. At that time, the National Park Service decided to delay completion of the Wilderness Plan so it would not preclude options for any other authorized uses that might surface during preparation of the GMP.

Nothing is proposed for wilderness designation in the GMP. The map included in this section indicates those lands which meet (545,645 acres) or potentially meet (128,730 acres) the criteria of the Wilderness Act of 1964. Following completion of the GMP, a wilderness plan will be prepared. Lands proposed for wilderness designation in that plan will be taken from the lands indicated on this map; other NRA lands will not be affected.

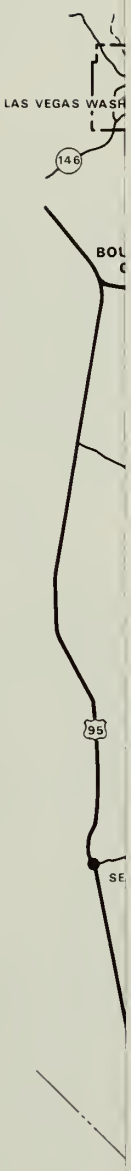
The following units are keyed by number to the Wilderness Criteria map. These units which meet or potentially meet the criteria of the Wilderness Act include most of the lands in the recreation area with primitive characteristics. Boundary lines of the units follow topographic features, access roads, the recreation area boundary line, section lines, and a line marking a 300-foot horizontal setback from the high waterlines of Lakes Mohave and Mead.

Units 1 and 2 - Newberry Mountains, Christmas Tree Pass

These units consist of 40,605 acres. They are bordered on the north by the Empire Wash access road, on the east by a 300-foot setback on Lake Mohave, and on the west and south by the boundary of the recreation area and Highway 71. The area centers on the Newberry Mountains, which rise to an elevation of 5,600 feet and offer a cool refuge from the heat of the surrounding desert lowlands. Davis Dam, the Mohave Power Plant, Katherine Landing, and Bullhead City are developments visible from the southern and eastern portions of this unit.

Unit 3 - Nellis Wash

This 15,870-acre unit includes portions of the isolated Newberry Mountains along the western side of the recreation area. Fingerlike




WILDERNESS Lands meeting the Wilderness Act Criteria)

POTENTIAL WILDERNESS (Lands potentially meeting the Wilderness Act Criteria)

| | WILDERNESS | POTENTIAL WILDERNESS |
|---|---|---|
| 1 | 7,650 | 0 |
| 2 | 32,955 | 0 |
| 3 | 15,870 | 0 |
| 4 | 0 | 15,295 |
| 5 | 17,970 | 640 |
| 6 | 17,635 | 0 |
| 7 | 15,145 | 0 |
| 8 | 25,605 | 0 |
| 9 | 29,665 | 0 |
| 10 | 2,045 | 0 |
| 11 | 0 | 14,645 |
| 12 | 0 | 13,030 |
| 13 | 40,835 | 0 |
| 14 | 13,875 | 0 |
| 15 | 17,115 | 0 |
| 16 | 6,680 | 0 |
| 17 | 14,545 | 0 |
| 18 | 18,820 | 0 |
| 19 | 24,040 | 0 |
| 20 | 10,610 | 0 |
| 21 | 25,580 | 0 |
| 22 | 16,665 | 0 |
| 23 | 9,885 | 80 |
| 24 | 22,095 | 0 |
| 25 | 8,545 | 0 |
| 26 | 14,620 | 0 |
| 27 | 7,720 | 0 |
| 28 | 14,020 | 0 |
| 29 | 13,895 | 0 |
| 30 | 15,143 | 460 |
| 31 | 16,480 | 0 |
| 32 | 12,100 | 0 |
| 33 | 0 | 83,980 |
| 34 | 14,905 | 0 |
| 35 | 32,215 | 0 |
| 36 | 10,710 | 600 |
| **TOTAL** | **545,645** | **128,730** |


# WILDERNESS SUITABILITY

## LAKE MEAD NATIONAL RECREATION AREA

ARIZONA - NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

602 | 20,047 C
FEB 85 | DSC


WILDERNESS Lands meeting the Wilderness Act Criteria)

POTENTIAL WILDERNESS (Lands potentially meeting the Wilderness Act Criteria)

| | WILDERNESS | POTENTIAL WILDERNESS |
|---|---|---|
| 1 | 7,650 | 0 |
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| 33 | 0 | 83,980 |
| 34 | 14,905 | 0 |
| 35 | 32,215 | 0 |
| 36 | 10,710 | 600 |
| TOTAL | 545,645 | 128,730 |

N

5 0 5 10 15 MILES
5 0 5 10 15 20 KILOMETERS

# WILDERNESS SUITABILITY

## LAKE MEAD NATIONAL RECREATION AREA

ARIZONA · NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

602 | 20,047 C
FEB 85 | OSC

drainages and alluvial fans extend eastward from the mountains toward Lake Mohave. Some mining has occurred within the unit. However, it is not obtrusive and no active mining occurs within the unit. A powerline corridor and access road form a boundary to the north and east. The Empire Wash acces road bounds the unit on the south, and the recreation area boundary forms its western edge.

Unit 4 - Cottonwood Valley

Cottonwood Valley potentially meets the criteria of the Wilderness Act because of outstanding mineral reservations. However, this outwash trending to the west provides solitude and isolation in a primitive setting just to the north of a major development at Katherine Landing. This 15,295-acre unit is bounded on the north, south, and west by existing access roads and on the east by the recreation area boundary. The terrain slopes gently westward toward Lake Mohave.

Unit 5 - Black Mountains

The Black Mountains, capped by 2,000-foot Mount Davis, provide a scenic background to users of Lake Mohave. Approximately 17,970 acres are included within this unit. Scattered washes and side canyons transect the Black Mountains from east to west as they wend their way to the Colorado River. The Four Corners-Eldorado Transmission Line forms the north boundary. The west boundary is 300 feet from the high waterline of Lake Mohave, the south boundary follows a series of roads of the Cottonwood Valley system, and the east boundary is the recreation area boundary line.

Unit 6 - Opal Mountain

Within this unit is a portion of the Eldorado Mountains, gently rolling hills, and outwashes extending to Lake Mohave. Rugged mountains, secluded valleys, and flat alluvial fans provide opportunities for seclusion and isolation in a setting of scenic splendor. The unit is bounded on the north by the Aztec powerline road, on the east by a 300-foot setback from Lake Mohave, on the south by the Opal Mountain Road, and on the west by the recreation area boundary. Approximately 17,635 acres are included within this unit.

Units 7, 8, 10, 11, and 12 - Fire Mountain and Black Canyon

These units are the most spectacular and rugged terrain within the area. They consist of steep barren rocky crags, which begin at an elevation of 645 feet and terminate at an elevation of approximately 2,200 feet. These units consist of 70,470 acres and combine to form the "Black Canyon" of Lake Mohave, which is noted for its hot springs and cool Colorado River. This area is a noted spot for visitors to see sharp and abrupt canyon walls and a myriad of geology. Units 11 and 12 only potentially meet the criteria of the act because the Bureau of Reclamation has identified these areas as potential locations for reclamation facilities ranging from modification

of Hoover Dam to new transmission line corridors. Each of these potential facilities could require a considerably larger area for construction activities than the principal construction, owing to required site for access roads, transmission and utility lines, and borrow pits.

Unit 9 - Eldorado Mountain

Contained within this 29,665-acre unit are the picturesque and rugged Eldorado Mountains. The unit is a maze of peaks and side canyons with vertical cliffs extending to the edge of the Colorado River. State Highway 60 forms the southern boundary; the Colorado River/Lake Mohave 300-foot setback constitutes the east boundary, the northeast side is bounded by the Mead-Liberty Transmission Line, and the recreation area boundary forms the west unit boundary.

Unit 13 - Kingman Wash

Approximately 40,835 acres are included within this unit. It is bordered on the north by the 300-foot horizontal setback from the high waterline of Lake Mead; on the west by Kingman Wash access road; on the south by U.S. 93; and on the east by access roads. An area used for intensive recreation and an area which may be needed as a powerline corridor are identified as nonwilderness along the east boundary. The undulating Black Mountains typify the topography of the region. Access to the unit is provided on all sides by existing road corridors.

Unit 14 - Bonelli Landing

This unit comprises 13,875 acres of mainly alluvial fans and separates the hilly mountainous area of unit 13 from the gypsum beds of unit 21. This unit contains some historic mining diggings and some archeological remains in the form of petroglyphs. Access to this unit is by the access road to Bonelli Landing and to Temple Bar.

Units 15, 16, and 17 - Pinto Valley

These three units comprise approximately 38,340 acres of rugged hills and highly scenic valleys. These units contain Guardian Peak, which is one of the highest peaks within the area and is used as a navigational aid. The northern side of Boulder Canyon is formed by these units, which is where steep cliffs or barren rock enter the cool blue waters of Lake Mead in a dramatic fashion. Pinto Valley is formed within these units and exemplifies a much photographed topography because of the red sandstone at outcroppings which merge with the green desert vegetation and the grays, browns, and yellows of the desert floor.

Unit 18 - Cathedral Wash

This 18,820-acre unit is bounded on the north, by the Echo Wash access road; on the east and south, by the 300-foot setback from

the high waterline of Lake Mead; and on the west, by Nevada State Highway 167 and the Boathouse Cove access road. Mountainous terrain representing the northeast extremities of the Black Mountains dominates the area and contrasts directly with the flat surface of Lake Mead.

Unit 19 - Overton

Most of this 24,040-acre unit consists of flat to "badland-like" lands sloping westward from mountainous terrain to a road corridor east of the recreation area boundary. The unit forms the scenic background for lake users and for shoreline users on the west side of Overton Arm. These flat outwashes lack the spectacular contrasts found within other units. This unit has a typical desert landscape. It has retained its primitive condition and affords an opportunity for seclusion and an unconfined type of recreation. On the north, the unit is bordered by the Narrows South access road; on the east, by the recreation area boundary; on the south, by the Catclaw access road; and on the west, by the 300-foot setback from Lake Mead.

Unit 21 - White Hills, Unit 22 - Temple Bar, and Unit 23 Gregg's Hideout

These units are located within the White Hills. They are characterized by isolation, seclusion, scenic views, and historic significance. This rolling hill country includes some evidence of earlier historic mining activities and trails associated with these efforts. The early methods of mining did not scar the area excessively, and many scars have healed to the point of not being noticeable. However, areas further to the west do not meet the Wilderness Act criteria because they have been severely scarred by modern exploration techniques and road construction. Unit boundaries consist of access roads, setbacks from Lake Mead, development areas, and recreation area property lines. Access to the area is possible from existing roads, hiking from developed areas such as Temple Bar, or by boat from Lake Mead. These three units contain approximately 52,130 acres.

Unit 20 and Units 24 through 32

These units are known as Twin Springs, Scanlon Wash, Hiller Mountains, Hell's Kitchen, Indian Hills, Cockscomb, Grand Wash Cliffs, Iceberg Ridge, South Cove, and Pearce Ferry. The units contain rugged mountain ranges which provide a scenic background for the Virgin Basin section of Lake Mead. Gently sloping outwash fans extend from the mountain fronts to plunge abruptly into the reservoir.

The units are bounded by a network of roads that provide access to developed areas or the lakeshore, by recreation area boundaries, and the lakeshore setback. The interior portions of these units are readily accessible from adjacent roads. Unit 20 contains 10,610 acres and units 24 through 32 contain approximately 125,078 acres.

Unit 30 - Shivwits Plateau

Approximately 83,980 acres are included within this unit. A diversity of activities occur in this remote section of Lake Mead, ranging from hunting to grazing. Due to a higher altitude, the region is cooler, has more precipitation, and supports pinyon/juniper and ponderosa pine forests. Therefore, it also contains a wider variety of wildlife, including the highest number of mule deer to be found in the recreation area. Big game hunting is a favorite recreational pursuit and probably accounts for the majority of visitation to this area. The cooler, wetter climate also provides for some of the better grasslands that sustain larger numbers of cattle per unit of area than other sections of the recreation area. Additional recreational activities include nature study, dry camping with a vehicle, rockhounding, exploring with four-wheel-drive vehicles, and hiking the superlative rim country. Kelly Point, Twin Point, and other points along the rim permit spectacular views of the Grand Canyon.

Because there are 66,350 acres of land within this unit which are subject to mineral reservations, the unit only potentially meets the criteria of the Wilderness Act.

Unit boundaries follow rims, internal access roads, and recreation area boundaries.

Several of the units may appear to be narrow and splintered by access roads. However, when considered along with the adjacent proposed wilderness in Grand Canyon, it is apparent that these would form a significant contiguous wilderness unit.

Unit 34 - Andrus Point, Unit 35 - Whitmore Point, and Unit 36 - Lava

These three proposed wilderness units consist of approximately 58,430 acres in the northeast sector of the recreation area. Contained within these units are Parashant, Andrus, and Whitmore canyons; all are precipitous side canyons of significant grandeur that drain into the Grand Canyon. The entire area is undeveloped land retaining its primeval character with the imprint of man's work substantially unnoticeable. It provides an opportunity for solitude or a primitive and unconfined type of recreation in a scenic setting of steep escarpments, colorful red walls, and deep canyons.

Geologic formations and processes in evidence here may provide information on the origin of the Grand Canyon, which is of interest to the scientific and educational communities. Also of interest to these communities are the archeological sites of several Indian cultures, including the Virgin Anasazi and more recently the Paiutes.

Grazing has occurred in this region for over 100 years, and the Lake Mead establishing act identifies grazing as an acceptable use. Roads and tanks or water pockets found to be needed for current

grazing operations and requiring road access are excluded from the wilderness proposal. All roads in this area and on the Shivwits Plateau serve dual roles in providing access for recreation and for grazing support purposes.

Unit boundaries consist of road systems, recreation area boundaries, and plateau rims. Adjacent primitive areas of Grand Canyon National Park provide for a contiguous unit of primitive lands extending westward from the Pine Mountains across the Sanup and Shivwits plateaus to the Grand Wash Cliffs.

## ECOLOGICAL COMMUNITIES

The ecological communities of Lake Mead can be most conveniently divided, like geology, into the Basin and Range Province and Colorado Plateau Province. The best way to describe wildlife in the park is to relate it to habitats represented by vegetational communities. There are three basic vegetation complexes in the two provinces with numerous subcommunities. The following describes all communities represented in Lake Mead, with emphasis on those communities that would be directly affected by the proposaled action.

### Desert Shrub Complex

In the Basin and Range Province of the recreation area the desert shrub complex is the most prevelant. Within the complex two distinct communities exist--the creosotebush and blackbrush communities. Because most proposals in the draft plan focus on the lake at existing or proposed developed areas and improved access points, the most affected community would be the creosotebush community. It generally exists around both lakes between 500 and 3,500 feet elevation. However, in many cases access to the lakes would necessitate going through the blackbrush community, which ranges between 3,000 and 4,000 feet elevation, and following washes that comprise the transzonal desert riparian community.

Table 17: Area of Ecological Communities

| | Acreage | Percentage |
|---|---|---|
| Basin and Range Province | | |
| Creosote Community | 1,040,000 | 70.2 |
| Blackbrush Community | 35,000 | 2.4 |
| Pinyon/Juniper Community | 2,800 | 0.2 |
| | 1,077,800 | 72.8 |
| Colorado Plateau Province | | |
| Pinyon/Juniper Community | 107,000 | 7.2 |
| Sagebrush Community | 59,000 | 4.0 |
| Blackbrush Community | 30,000 | 2.0 |
| Creosote Community | 12,000 | 0.8 |
| Oak Woodland Community | 1,200 | 0.1 |
| | 209,200 | 14.1 |
| Aquatic Areas | | |
| Reservoir Community | 186,000 | 12.50 |
| Stream/Riparian Community | 2,000 | 0.10 |
| Springs Community | 100 | 0.01 |
| | 188,100 | 12.61 |
| Developed Area | | |
| Disturbed Communities | 7,300 | 0.50 |
| Total | 1,482,400 | 100.00 |

The creosotebush community is found in the western and central portions of the recreation area. The most extensive stands are found northeast of Lake Mead in the Twin Springs and Scanlon Wash areas. It is locally well developed on lower bajadas, alluvial fans, and playas. It may be found occasionally at higher elevations on arid, south-facing slopes. Near the Colorado River, the topography occupied by this community is especially rocky and rugged. Soils typically develop on gray alluvium and generally have high salt-alkali contents that often form caliche hardpans. This community has extreme fluctuations of daily and seasonal temperatures and precipitation. Vegetation cover is sparse in this community and dominated by creosotebush and bursage. Other species common to this community are Mormon tea, brittlebush, range ratany, and indigo bush. Following the period of above-average precipitation, profusions of annual wildflowers can be observed.

Diurnal lizards and nocturnal snakes are relatively common reptiles in this community. The Gila monster reaches its northernmost range in this area, but like the chuckwalla and the desert tortoise, it is not abundant. Densities of bird species are low. Gambel's quail, raven, desert sparrow, horned lark, roadrunner, and the cactus and rock wrens occur in this community. Five species of bats are common to abundant as are seven species of small rodents. The blacktail jackrabbit and the desert cottontail sometimes become locally abundant. Carnivores such as the coyote, kit fox, badger, and bobcat are relatively common, depending on the supply of smaller animals. The feral burro, wild horse, and domestic

livestock graze within this community, and the desert bighorn is rarely found in rugged terrain of this community.

The blackbrush community is similar but of greater density than the creosotebush community. Although small in total area, it is widely scattered throughout the recreation area. This community is predominate in Grand Wash and is secondary in areas adjacent to the Colorado River from Callville Bay to Davis Dam. Small isolated stands are occasionally found at higher elevations. The soils of this community are generally more porous, have lower salt content, are more permeable, and have slightly higher organic contents than the soils of the creosotebush community.

Plants frequently associated with this community include Joshua tree, Mormon tea, rabbitbrush, matchweed, and flat-topped buckwheat. While the herbaceous composition is generally the same as the creosotebush community, perennial grasses such as Indian rice grass and needle grass are more abundant.

Reptiles are well represented in the blackbrush community, but there are not as many as in the creosotebush community. Sage sparrow, ladder-backed woodpecker, raven, and cactus and rock wrens are the more abundant resident birds. Most mammals that are residents of the creosotebush community also inhabit this community. Desert bighorn sheep graze in the upper elevations. Other grazing animals include nonnative burros, horses, and domestic cattle. Competition exists among these animals for forage and water. Bighorn sheep and burros frequently compete for scarce water sources, but with the reservoirs available this competition is reduced. Grazing impacts on rare, threatened, or endangered plants has not been adequately studied to know the level of effect.

The desert riparian community comprises vegetation in local desert washes, which is not dramatically different in growth-form from that of the surrounding desert shrub communities. Plants are comparable but usually occur in greater density in the desert riparian community. As a result, it is commonly recognized as a transzonal rather than distinct community. Like its Sonoran counterpart, it is scattered like fingers through the landscape. Roadsides are quite similar to these washes because of concentrated water runoff from the pavement surface. Soils are usually silty to sandy but become quite rocky at the higher elevations. As would be expected, increased subsurface water may be available, allowing greater densities of plants. Mesquite, catclaw acacia, desert willow, cheeseweed, and tamarisk give this community a slightly more developed appearance. On portions of the Colorado River upstream from Lake Mead, ocotillo can be found along the edges of this community, which also extends into major laterals such as Whitmore and Andrus canyons.

Animal species are also similar to those of the surrounding communities; the major difference is that they occur more frequently. The sidewinder is a common inhabitant, and desert wood rats are frequently found in this environment because it offers more abundant food and cover sources than do the adjoining communities. These factors undoubtedly account for the

greater density of desert birdlife found here. Feral burros and domestic cattle also use this ecosystem.

Woodland Vegetation Complex

This complex in the Basin and Range portion of the recreation area is represented by only the pinyon/juniper community. The Newberry Mountains area near the southwest corner is the only area exhibiting this higher growth-form and more complex interrelationship of plant and animal life. Nothing has been proposed which would directly affect this area.

Generally surrounded by the blackbrush community, this area receives a greater amount of annual precipitation that supports the more developed community. The dominant species of plants in this community are the California juniper and the pinyon or single-leaf pine. Herbaceous plants are well represented.

Reptiles are not as well represented here as in the communities at lower elevations. Bird species include rock wren, red-tailed hawk, common bushtit, western bluebird, and Gambel's quail. Mammals are well represented, and the area is a major locality for upland game hunting. Several signs and positive sightings of bighorn sheep have recently been made nearby. Common carnivores include bobcat, coyote, and gray fox. Domestic livestock and feral burros have frequented and continue to use this community. Except for occasional trespass, domestic livestock and feral burros do not use this community in the Newberry Mountains.

Aquatic Community Complex

This complex contains four distinct communities in the recreation area--desert spring, lake, stream, and stream riparian communities. Evidence concerning the desert spring community indicates that a larger number of desert springs flowed historically. A major concentration of active springs occurs on each side of the Colorado River between Hoover Dam and Willow Beach where no proposals have been made. However, proposals have been made at Rogers and Bluepoint springs north of Echo Bay.

Many springs are thermal, and water temperatures vary slightly on an annual basis. Various aquatic plant species can be expected, and the peripheries of springs may have a number of sedges, rushes, cattails, salt grass, and salt-tolerant shrubs. Cottonwoods, mesquite, desert willow, and tamarisk may also be found in these mesic soils. Formerly active springs or water catchments provided greater water availability, indicated by the presence of cottonwoods, mesquite, scrub oak, and wild grape.

Although use of local springs as watering sites by resident and migrant birds may not be as great as during preimpoundment days, the springs continue to provide considerable shelter for the park's bird populations. Many springs are critical for bighorn sheep, feral burros, cattle, deer, and many small mammals.

The lake community contains several variables that influence vegetation and distributions of game fish. This community would only be affected by proposals to use fill to reclaim land from the lakes and in construction of new launch ramps.

Lake Mohave, with its cold upstream water temperatures, has long been known for its excellent trout fishing. Rainbow trout are planted by the Fish and Wildlife Service directly into Lake Mohave from the Willow Beach Hatchery. The states of Nevada and Arizona have previously planted kokanee salmon on an experimental basis with little success. Late each spring, the transition zone between colder uplake and warmer downlake waters provides an extremely vivid rust-to-near-orange display of algae in the Chalk Cliff to Money Cove area. A noticeable change in game fish composition is associated with this six-mile transition zone. Below the transition zone one can expect fewer trout and an increasing number of largemouth bass. However, this fact is less noticeable today because of increased downlake stocking of rainbow trout and other salmonids. Although it has not been determined how striped bass entered Lake Mohave, it has been confirmed that they are now established in the Lake. This introduction may affect the trout fishing in the future.

Use of the lake community by birds such as western and eared grebes, gulls, egrets, herons, several species of shorebirds, bald and golden eagles, white pelicans, and ospreys is significant. Although not all use the lake community for the basic necessities of food, shelter, or escape cover, most are closely associated to the lake, stream riparian, and stream communities. The beaver and raccoon in Lake Mohave are the sole mammalian representatives of this community.

The stream community is limited to the muddy waters of the Colorado River (upstream from Lake Mead), Muddy and Virgin rivers, and to the clear or relatively nonsilted lower reaches of Las Vegas Wash and the Colorado River below Hoover and Davis dams. Nothing has been proposed which would affect these areas.

Several variables, including turbidity, depths, widths, velocity, and temperature, influence vegetation within this community. Numerous endemic nongame and nonnative fishes currently inhabit the community. Carp and channel catfish predominate in the muddy waters of the Colorado River. The introduced striped bass and rainbow trout provide a major sport fishing resource in river waters below Davis Dam. Beaver, muskrat, and soft-shelled turtle are reportedly found in the Virgin and Muddy rivers and below Davis Dam in the Colorado.

The stream riparian community is found along Las Vegas Wash and the Muddy, Virgin, and Colorado rivers. Narrow mesic canyons of the Newberry Mountains containing intermittent flows also support riparian vegetation. In addition, limited and scattered shoreline environments of Lakes Mead and Mohave display similar characteristics when lake elevation fluctuations are minimized. For the most part, this is not a natural situation, but rather is manipulated by man as lake levels fluctuate and exotics invade disturbed areas. Proposals that might affect this community are limited to shoreline areas.

Fremont poplar, willow, desert willow, cattail, mesquite, and the nonnative tamarisk might exist. Sedges, rush, monkey flower, and grasses can also be found within this community. Amphibians are represented by the spade-foot toad, the red spotted toad, the introduced bullfrog, and by the tiger salamander introduced in larval form as fishing bait. Skunks, beavers, desert bighorns, feral burros, domestic cattle, and coyotes are particularly noticeable in this community.

Colorado Plateau

Although this province contains communities representative of the three basic vegetational complexes, it is discussed separately for two reasons. First, because of the differences in elevation and climate from the Basin and Range province, the composition and density of similar communities can be dramatically different. Second, there is little proposed which will have an effect on the Shivwits Plateau so a detailed description is not necessary. Five distinct communities and one transzonal community are in the area.

The most abundant community on the Shivwits Plateau, the pinyon/juniper association, extends from Snap Point east to Andrus Canyon. Although the Utah juniper and pinyon are the dominant plants, ponderosa pine and big sagebrush stands are scattered throughout this community along major drainages. Therefore, portions of this association might vary considerably, with the typical woodland merging into a forest association of ponderosa pine or an extremely sparse stand of juniper with a dense understory of big sagebrush. Plants frequently found in this community are Gambel oak, gooseberry, squawbush, snowberry, and fleabane.

The sagebrush community consists mainly of sagebrush and rabbitbrush and dominates large portions of the Shivwits Plateau. Other plants frequently associated with these indicators are matchweed, rubberweed, cliffrose, Apache plume, and on limestone outcrops, Agave.

The pinyon/juniper and sagebrush communities comprise the major areas used for cattle grazing. Mule deer, wild turkey, coyote, badger, pack rat, gopher, field mouse, cottontail, and blacktail jackrabbit, Gambel's quail, redshafted flicker, raven, scrub jay, Oregon junco, white breasted nuthatch, rattlesnakes, and several lizards are some of the resident and transient wildlife.

Although more extensive areas of the oak woodland community are adjacent to the recreation area (Mt. Trumbull and Oak Grove Hill), some isolated stands occur in areas of limited exposure on the Shivwits Plateau. Southerly exposures support a sparse stand of Gambel oak with an impenetrable understory of manzanita, while northern exposures are more diverse and support Gambel oak, the New Mexico locust, pinyon and ponderosa pine, Utah juniper, barberry, and chokecherry.

The blackbrush and the creosotebush communities are dominant at lower elevations in the Colorado Plateau province of the park. These communities are similar in structure to those described previously for the Basin and Range portion.

The sheer cliffs that separate the Shivwits and Sanup plateaus comprise the transzonal community in the area. Vegetation and wildlife are generally rare in this community, with the exception of several species of bats and small rodents that utilize the many caves in the cliffs. Bighorn sheep are known to be transient throughout the community while they range between plateaus.

### Developed/Improved Access Areas

There are dramatic differences between these man-made areas and the natural vegetational communities that surround them. All existing and proposed developed areas occur in the creosotebush community close to the lakes. The vegetation in these areas is a sampling of exotic and native species. Intermingled with islands of natural vegetation typical of the creosotebush community are manicured lawns, oleanders, fan palms, flower gardens, and other exotic species. Natural drainages and runoff patterns have been altered by flood-control structures, roads, parking areas, and buildings causing changes in soil moisture content and subsequently species composition. Wildlife species typical of the surrounding community occasionally enter or pass through developed areas, but this is a rare occurrence because of the noise and activity associated with the areas.

It is relatively safe to assume that virtually everything within the confines of developed areas has been previously disturbed.

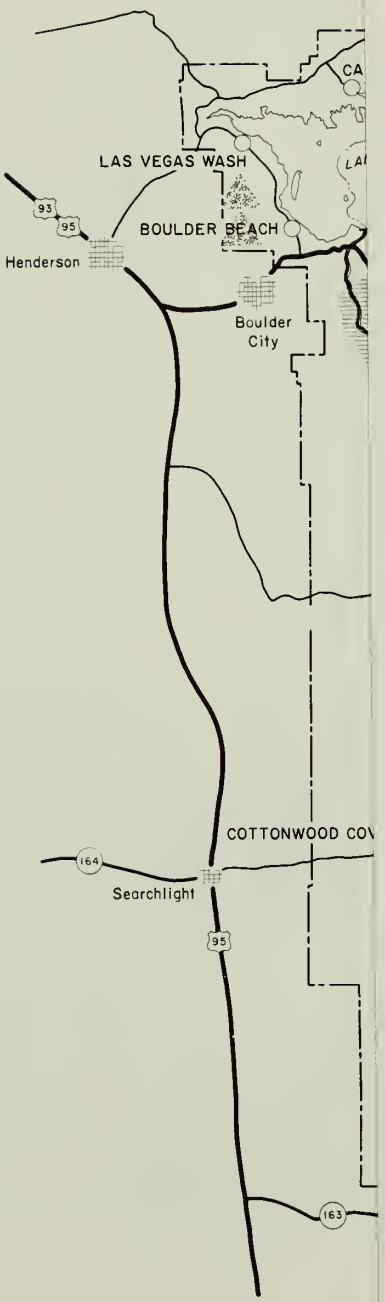
Although not as dramatic, all the proposed improved access points have been altered by man. These points not located at the mouths of washes but near the shoreline are also within the creosotebush community. Because of the flood hazard, no points have been located in washes but access may be through the wash or development nearby. All affected washes occur in the desert riparian, transzonal community. Some isolated stream riparian communities may also be nearby. No improved access point has been proposed which has not historically been used by visitors for camping. The disturbance is not as drastic as in developed areas, but roads, trails, and popular campsites have altered the natural vegetation and wildlife habitats.

## THREATENED, ENDANGERED, OR OTHER RARE SPECIES

Pursuant to section 7 of the Endangered Species Act of 1973, as amended, a list of threatened, endangered, or candidate species and critical habitat that are present or may be present in the recreation area was requested from the U.S. Fish and Wildlife Service (USF&W) on February 15, 1983. Their reply, dated April 8, 1983 (see appendix B), is the most up-to-date information available at this time. There are no threatened or endangered species of plants, proposed species, or critical habitat in Lake Mead. The endangered bonytail chub, Gila elegans, and the threatened bald eagle, Haliaeetus leucocephalus are the only two federally listed animal species that are known to occur within the recreation area (see Threatened, Endangered, or Other Rare Species map and table).

Although not officially listed, there are a number of species that do or could occur in the recreation area that are listed as candidate species. Some of these species are listed as threatened, endangered, or species of concern by the states of Arizona and Nevada. Refer to table 18 for the status and legal classification of all these threatened, endangered, or other rare species. Of these 19 species, 14 are known to occur in the recreation area. Of those 14, six are rare migratory transients in the recreation area with wide distributions outside the area. Thus, only eight are of concern.

Those eight species' ranges in the recreation area are shown on the Threatened, Endangered, or Other Rare Species map. They will be protected by the National Park Service and will be constraints on planning within the recreation area.




DESERT TORTOISE -infrequent occurrence throughout NRA,except Shivwits plateau (not shown)

RAZORBACK SUCKER

WINTERING BALD EAGLE HABITAT

KNOWN GILA MONSTER HABITAT

BONYTAIL CHUB RECOVERY COVE

PLANT SPECIES (Eriogonum viscidulum Arctomecon californica, Penstemon bicolor ssp. roseus, Astragalus geyeri var. Triquestus, Cryptantha insolita, Opuntia basilaris var. treleasei, and Rosa stellata)

N

5 0 5 15 MILES

5 0 5 10 15 20 KILOMETERS

# THREATENED ENDANGERED AND OTHER RARE SPECIES

## LAKE MEAD NATIONAL RECREATION AREA

ARIZONA-NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

602 | 20,049 C
FEB 85 | DSC


DESERT TORTOISE -infrequent occurrence throughout NRA, except Shivwits plateau (not shown)

RAZORBACK SUCKER

WINTERING BALD EAGLE HABITAT

KNOWN GILA MONSTER HABITAT

BONYTAIL CHUB RECOVERY COVE

PLANT SPECIES (Eriogonum viscidulum, Arctomecon californica, Penstemon bicolor ssp. roseus, Astragalus geyeri var. Triquestus, Cryptantha insolita, Opuntia basilaris var. treleasei, and Rosa stellata)

N

3 0 3 15 MILES

5 0 5 10 15 20 KILOMETERS

# THREATENED ENDANGERED AND OTHER RARE SPECIES

## LAKE MEAD NATIONAL RECREATION AREA

ARIZONA-NEVADA

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602 | 20,049-C
FEB 85 | OSC

Table 18: Status of Threatened, Endangered, or Other Rare Species

| | | Status | | | | Legal Classification | | |
|---|---|---|---|---|---|---|---|---|
| | | R | E | V | D | USFWS | NV | AZ |
| Mammals | | | | | | | | |
| Spotted bat | Euderma maculatum | -- | -- | -- | 0 | C | -- | E |
| Fishes | | | | | | | | |
| Razorback sucker | Xyrauchen texanus | 1 | 1 | 1 | 3 | C | T | -- |
| Bonytail chub | Gila elegans | 3 | 3 | 3 | 3 | E | E | |
| Birds | | | | | | | | |
| Bald eagle | Haliaeetus leucocephalus | 1 | 2 | 1 | 1 | E | E | T |
| White-faced ibis | Plegadis chihi | 0 | -- | -- | 1 | C | -- | -- |
| Swainson's hawk | Buteo swainsoni | 0 | -- | -- | 1 | C | -- | -- |
| Ferruginous hawk | Buteo regalis | 0 | -- | -- | 1 | C | -- | -- |
| Western snowy plover | Charadrius alexandrinus nivosus | 0 | -- | -- | 1 | C | -- | -- |
| Mountain plover | Charadrius montanus | -- | -- | -- | 0 | C | -- | -- |
| Long-billed curlew | Numeius americanus | 0 | -- | -- | 1 | C | -- | -- |
| Western yellow-billed cuckoo | Coccyzus americanus occidentalis | 0 | -- | -- | 1 | C | -- | -- |
| Reptiles | | | | | | | | |
| Desert tortoise | Scaptochelys agassizii | 1 | 1 | 1 | 1 | C | T | C |
| Gila monster | Heloderma suspectum | 1 | 1 | 1 | 1 | C | -- | C |
| Plants | | | | | | | | |
| Sticky buckwheat | Eriogonum viscidulum | 3 | 3 | 1 | 2 | C | -- | E |
| Bear paw poppy | Arctomecon californica | 1 | 1 | 1 | 2 | C | -- | E |
| Bicolored penstemon | Penstemon bicolor ssp. roseus | 2 | 3 | 1 | 2 | C | -- | -- |
| milk-vetch | Astragalus geyeri var. triquetrus | 3 | 3 | 2 | 2 | C | -- | -- |
| catseye | Cryptantha insolita | 3 | 3 | 3 | 2 | C | -- | -- |
| Bakersfield beavertail cactus | Opuntia basilaris var. treleasei | 3 | 3 | 2 | 2 | C | -- | -- |
| rose | Rosa stellata | 1 | 1 | 1 | 1 | C | -- | -- |

Status

R-Rarity
- 0 Uncommon or rare transient throughout the recreation area
- 1 Uncommon, of limited distribution, but distributed widely enough within the recreation area that potential for extirpation is currently low
- 2 Rare, occurrence confined to several populations or one extended population within the recreation area
- 3 Occurs in very few highly restricted populations

E-Endangerment
- 1 Not endangered within the NRA
- 2 Population within NRA endangered or threatened in part of range
- Population within NRA endangered or threatened on all or the greater part of its range

V-Vigor
- 1 Stable or increasing
- 2 Declining
- 3 Approaching extirpation

D-Distribution
- 0 No confirmed records of occurrence in the recreation area
- 1 Widely distributed outside Lake Mead National Recreation Area
- 2 Regional endemic (restricted to counties surrounding Lake Mead in Nevada and/or Arizona)
- 3 Distributed outside the immediate region of the recreation area but range restricted

Legal Classification (All animals are protected within the recreation area).
- E - Endangered (or equivalent designation)
- T - Threatened (or equivalent designation)
- C - Candidate Species or Rare
- USFWS - U.S. Fish & Wildlife Service
- NV - Nevada
- AZ - Arizona

## FLOODPLAINS AND WETLANDS

National wetlands inventory maps are not available for the area. However, wetland environments are rare within the recreation area, and none exist along the lakeshore because of the wide variation in water levels. Wetland areas include Rogers and Bluepoint springs, the stream riparian environment in Las Vegas Wash, and the Virgin and Muddy River flats at the north end of the Overton Arm.

Many of the popular visitor use areas at Lake Mead, both developed and undeveloped, are subject to flash flooding. NPS guidelines define flash flood as one in which the flood waters rise so rapidly that there is insufficient time for warning and evacuation of persons threatened by the flood. NPS guidelines classify such flash-flood areas as high hazard areas and require that specific management actions be taken to reduce the flood hazard. Thus, when studies reveal that existing structures or facilities are subject to flash flooding, as they are in Lake Mead, a plan of action must be prepared.

This plan defines the probable maximum floodplain (PMF) and 100-year floodplain. The 100-year flood is the average maximum flood that can be expected to occur every 100 years. Floods of this magnitude occur frequently enough to pose a serious threat to all facilities and people. The PMF is the largest flood that can ever be expected to occur in an area; however, these floods are rare, and their statistical probability of occurring is uncertain. They have occurred on occasion; for example, in 1974 at Eldorado Canyon on Lake Mohave a flood occurred that was 7.6 times larger than the calculated 100-year flood and two-thirds of the calculated PMF (USDI, GS 1949).

### Methodology for Estimating Flood Flows and Designing Mitigation Measures

The Park Service produced a series of "Flood Hazard Studies" (USDI, NPS 1982c) that analyzed 100-year and probable maximum floodplains and presented alternative designs for structural flood mitigation measures. The major developed areas analyzed in these studies included Katherine, Cottonwood Cove, Willow Beach, Boulder Beach, Las Vegas Wash, Overton Beach, and Temple Bar. Because the design of these facilities is so critical for protecting life and property, the Park Service wanted to test their efficiency. Flood Loss Reduction Associates was hired to provide an independent evaluation (1983) of the Park Service structural mitigation proposals for Temple Bar, Cottonwood Cove, and Katherine Landing. Their analysis did not reveal any major flaws, but it did recommend several minor changes that would improve the designs. These recommendations have been incorporated into the structural mitigation plans that are presented in the development concept plans.

The calculations for flash-flood flow take into consideration the rate of precipitation, size of drainage, time of flood concentration, length of drainage, change in elevation within the drainage, duration of precipitation, and amount of runoff after absorption in the soil.

Precipitation for the 100-year thunderstorm was determined using the procedures and isopluvials in NOAA Atlas 2, Volume XI, prepared by the National Oceanic and Atmospheric Administration. Precipitation for the probable maximum thunderstorm was determined using the procedures and isohyets as prescribed in Design of Small Dams, Second Edition, prepared by the Bureau of Reclamation. Runoff was determined by the procedures described in Design of Small Dams. Flood extents were determined using Manning's formula with "n" values of 0.045. Cross sections showing flood flows at strategic locations within each drainage were calculated. This information was then converted to topographic maps. The 100-year and PMF extents are shown on the Development Concept Plan maps for all areas that have flash-flood hazards--Katherine, Cottonwood, Willow Beach, Las Vegas Wash, Overton Beach, and Temple Bar.

Table 19 describes the level of floodplain information available for each developed area.

Table 19: Status of Floodplain Information

| | Floodplain Mapped | | | Agency | | | |
|---|---|---|---|---|---|---|---|
| Developed Area | 100 | 500 | PMF | NPS | USGS | CORPS | Pvt. |
| Katherine Landing | X | X | X | X | X | | |
| Cottonwood Cove | X | X | X | X | X | | X |
| Willow Beach | X | X | X | X | X | | X |
| Boulder Beach* | X | | | X | | | |
| Las Vegas Wash | X | X | X | X | | X | |
| Callville Bay | No hazard | | | | | | |
| Echo Bay | No hazard | | | | | | |
| Overton Beach | X | | X | X | | | |
| Temple Bar | X | X | X | X | | X | |
| South Cove | X | | X | | | X | |
| Pearce Ferry | X | | X | | | X | |

*Cross sections only

The Corps of Engineers has also mapped the 100-year, 500-year, and PMF floodplain for the following undeveloped, but popular, visitor use areas: Gypsum Wash, Government Wash, Boxcar Cove, Kingman Wash, Detrital Bay, Gregg's Hideout, Hualapai Wash, and Aztec Wash.

Because the Park Service did not have extensive experience with nonstructural flood mitigation measures (warning systems, emergency preparedness, and facility relocation), Flood Loss Reduction Associates was hired to do a preliminary evaluation (1982) of nonstructural flood loss reduction measures. Their study recommendations have been included in the development concept plan proposals. They are also proceeding with a

study to refine the proposed nonstructural flood mitigation measures--design of needed warning systems, emergency preparedness measures, evacuation plans, and flood information/education plans.

## Floodplain Conditions

Flood hazard is most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor use facilities are out of the floodplain. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain.

The floodplain for Boulder Beach is on a broad alluvial fan. Flood flows across such fans often change course during flood events and are otherwise unpredictable. Their flows can concentrate, but generally tend to spread out in sheet flows that are not as dangerous to human safety as flash-flood flows concentrated in canyons. Currently earth dikes above the area's developments concentrate flows in drainage channels that run between facilities. These earth dikes are not designed to withstand a major flood event, and their failure could result in substantial sheet flows reaching developments. Because of the uncertain structural integrity of the earth dikes and the changing nature of the flood flows at Boulder Beach, a map of the floodplain would be misleading and inaccurate; and therefore, was not produced. To portray the situation accurately, all facilities and property should be considered to be in jeopardy of damage from locally concentrated flows or sheet flows (a foot or two deep, but usually shallower), but they would not be destroyed. People are not likely to be killed by sheet flows (some danger remains especially for children, elderly, or the disabled), but locally concentrated flows tend to be deeper and could threaten life. The flood-hazard zone that shows on the DCP graphic for Boulder Beach is a drainage channel that has had numerous flood flows concentrated in it in the past. Otherwise the entire area is susceptible to low sheet flows or unpredictable, locally concentrated flows.

At the existing improved access points, South Cove and Pearce Ferry improvements are out of the flash floodplain or have been signed to warn visitors of the hazard. At the proposed improved access points there is either no flood hazard or no space to locate improvements out of the floodplain. Location of floodplains is shown on the maps for the individual development concept plans.

Table 20 lists developments in the 100-year and PMF. Structures in the floodplain might be damaged or destroyed if a flood occurred. Structures listed in the 100-year floodplain are also in the PMF. However, to avoid repetition, only structures that are in the PMF but not the 100-year floodplain are listed in the PMF column.

Table 20: Development in the 100-Year and Probable Maximum Flood (PMF)

| | Existing Conditions | |
|---|---|---|
| | 100-year | PMF |
| Katherine Zone | | |
| Access<br>No. & So. Telephone Coves primitive use area and access | 1.9 mi., gravel | |
| Circulation roads to NPS housing | 1,950 feet, gravel | |
| Parking<br>East of motel | | 700-car, gravel |
| West of motel | | 500-car, paved |
| Launch ramp/ready lane | | 8 lanes, 150 feet x 200 feet, paved |
| NPS maintenance | | Two 800 sq. ft. bldgs.<br>1.5 acres unpaved storage<br>800' fence |
| NPS and concession housing | | 1 permanent single family |
| Trailer Village | | 33 short-term sites to be relocated |
| Motel | | 52 units |
| Dry boat storage | 210 spaces | |
| Icehouse | | Small bldg. |
| Comfort station | Small bldg. | |
| Cottonwood Zone | | |
| Access roads* | | 5 miles, paved |
| Circulation | | 2.6 miles, paved |
| Parking | 290 paved<br>148 gravel | 200 paved<br>90 gravel |

| | Existing Conditions | |
|---|---|---|
| | 100-year | PMF |
| Ranger station | 1,800 sq. ft. bldg. | |
| NPS maintenance | 3,000 sq. ft. bldg.<br>pave 25,000 sq. ft.<br>add 600' fence | |
| NPS housing | Three 1,200 sq. ft. houses, 700-800 sq. ft. trailers, 1,070' paved road | |
| Picnic area | 4 tables<br>1 large ramada | |
| Campgrounds (2)* | | 149 sites |
| Trailer village* | | 206 long-term sites; 75 short-term sites |
| Motel | | 24 units |
| Restaurant* | | 35 seats |
| Store* | | 1,200 sq. ft. |
| Dry boat storage | 350 spaces | |
| Concession maintenance | 4,400 sq. ft. bldg.<br>35,600 sq. ft. paved storage | |
| Concession housing | | 6 trailers<br>300' gravel road |
| Gas station* | | 2 pumps |
| Comfort station* | | Small bldg. |
| Fish-cleaning station | Small bldg. | |

*The 100-year flood was contained in existing earth dikes and channels (see DCP maps) in the Cottonwood area. However, the study indicates that the dike above the employee housing area would probably be breached or overtopped by the 100-year flood and could be in a hazardous location depending on the location of the dike overtopping or breeching. Larger floods may endanger the campground and mobile home area. The 850-foot section of the dike that parallels the trailer village on the north may only control the 50-year flood. Breeching or overtopping of this section of the dike would allow floodwaters to enter the trailer village and perhaps the store, restaurant, motel, associated parking area, gas station, and comfort station.

| | Existing Conditions | |
|---|---|---|
| | 100-year | PMF |
| Willow Beach Zone | | |
| Access roads | | |
| Main access | 2 mi, 2 lane | |
| 2 of 4 miles in floodplain | paved | |
| Trailer village access | 1/2 mi, gravel | |
| Parking | 164 paved spaces | |
| Launch ramp | 8 lanes | |
| Ranger station | 1,000 sq. ft. | |
| NPS maintenance | 1,500 sq. ft. bldg.<br>7,200 sq. ft. paved area<br>250' fence | |
| NPS housing (closed) | Four 1,200 sq. ft. houses | |
| Trailer village | 57 long-term sites<br>18 short-term sites | |
| Motel | 24 units | |
| Restaurant | 100 seats<br>4,900 sq. ft. | |
| Store | Part of restaurant | |
| Dry boat storage | 120 spaces | |
| Concession housing (trailer village) | Ten 1,200 sq. ft. trailers | |
| Water well buildings | Three 10' x 10' bldgs. | |
| Canoe/raft takeout | Graded area | |
| Sewage lagoons | | One 1 acre; one .5 acre |

| | Existing Conditions | |
|---|---|---|
| | 100-year | PMF |
| Las Vegas Wash | | |
| Launch ramp | | 5 lanes |
| Overton Beach | | |
| Swim beach | 1 acre | |
| Campground | | 100 primitive sites |
| Temple Bar | | |
| Parking | | 95 spaces paved |
| Launch ramp | | 4 lanes |
| NPS maintenance | | 2,000 sq. ft. bldg.<br>22,000 sq. ft. paved area<br>850' fence |
| NPS housing | | 1,500 sq. ft., single family |
| Campground** | | 153 sites |
| Trailer village** | | 122 sites |
| Motel* | | 22 units |
| Restaurant | | 76 seats |
| Store | | 1,500 sq. ft. |
| Concession housing | | 14 trailers |
| Gas station | | 2 pumps |
| Icehouse | | Small bldg. |
| Comfort Station | | 400 sq. ft. |

**Although the mapped 100-year floodplain (see DCP graphic) shows flood flows contained by existing earth dikes and channels, those structures are not likely to hold up during such a flood event. Their failure would especially jeopardize the campground, trailer village, and motel.

If a PMF level flood occurred at the recreation area, people would most likely be adversely affected. Table 21 shows an estimate of the numbers of people that would be in the PMF on an average summer weekend day.

Table 21: People in Probable Maximum Floodplain

| Developed Area | Existing Conditions Day | Night |
|---|---|---|
| Katherine | 1,095 | 1,120 |
| Cottonwood | 1,735 | 1,590 |
| Willow Beach | 490 | 360 |
| Las Vegas Wash | 40 | 0 |
| Overton Beach | 315 | 550 |
| Temple Bar | 1,170 | 1,250 |
| Total | 4,845 | 4,870 |

The totals from table 21 represent 5 percent of the total visitation of approximately 96,000 that Lake Mead would have on an average summer weekend day.

In the event of flooding at the recreation area, structures would be damaged or lost. Table 22 provides estimates of the costs of repairing the damage caused by the 100-year and PMF. The costs do not include items such as utilities, furnishings, equipment, vehicles, debris removal, or search and rescue. Expenses of victims, such as those for medical help, funeral expenses, and lost wages caused by death or injury are not included.

Table 22: Estimated Costs of Facility Replacement from 100-Year and Probable Maximum Flood

| Developed Area | 100-Year | Probable Maximum Flood |
|---|---|---|
| Katherine | $ 533,860 | $ 3,148,420 |
| Cottonwood | 2,049,960 | 9,535,320 |
| Willow Beach | 3,990,600 | 4,095,600 |
| Las Vegas Wash | 0 | 31,250 |
| Overton Beach | 4,280 | 0 |
| Temple Bar | 0 | 3,644,370 |
| Total | $ 6,578,000 | $20,457,250 |

## WATER RESOURCES

The springs in the recreation area vary widely in water quality and in flow characteristics. Many are intermittent, seasonal, and contain high concentrations of dissolved salts. Groundwater exists in several water-bearing aquifers, primarily ancient streams and river gravels capped by basaltic lava.

The major rivers supplying water to the recreation area are the Colorado, Virgin, and Muddy rivers. Flows from the major source, the Colorado

River, are controlled upstream by the Glen Canyon Dam, which intercepts 80-85 percent of the sediment which formerly entered Lake Mead. Most of the streams in the recreation area are intermittent or ephemeral and are subject to seasonal flash flooding primarily in the late summer and early fall months. Las Vegas Wash generally flows year-round because it is the outflow for municipal and industrial wastewater from Las Vegas.

Lakes Mead and Mohave are the primary water resources in the region. Lake Mead has a 247-square-mile (162,700-acre) water surface capacity, while Lake Mohave has a 45-square-mile (28,800-acre) capacity. Except for the extremely cold water below Hoover Dam, the lakes are ideal for swimming during the summer and fall months. Boating and water-skiing are other primary uses during the same period. Fishing in both lakes is a primary activity throughout the year.

All developed areas have water and sewage systems. Potable water is obtained from a Basic Management Incorporated (BMI) waterline at Las Vegas Wash; from wells about 150 feet deep at Cottonwood Cove, Willow Beach, and Temple Bar; and directly from the lakes at the remaining areas. It is then filtered, chemically treated, and stored for use in NPS and concession facilities. Wastewater is disposed of by evaporation from lined sewage lagoons at all areas, except Boulder Beach and Callville Bay where lagoons are unlined. Most of the developed areas have relatively new systems capable of handling much greater demand. Only the systems at Callville Bay and Willow Beach developed areas need to be expanded. All systems comply with state and local health standards and are monitored regularly. Although potable water is not provided at undeveloped access points around the lakes, heavily used areas generally have pit or chemical toilets.

Water quality standards of the state of Arizona specify that Lake Mead and Lake Mohave are to be protected for aquatic life (as a cold water fishery) and wildlife, full body contact recreation, agricultural irrigation, agricultural livestock watering, and as a domestic water source. These standards include allowable limits for various water quality parameters for each of these protected uses.

The state of Nevada water quality standards do not specify protected uses for the Colorado River but do identify numerical (and narrative) standards that must be met at various locations within Lake Mead NRA. These locations include Las Vegas Wash, 0.5 mile downstream of Willow Beach, and 0.5 mile downstream of Davis Dam.

Based on available water quality data and the protected uses of water within Lake Mead NRA, water quality in Lake Mead and Lake Mohave is generally in compliance with established water quality standards throughout the year. However, isolated instances do occur where bacteriological pollution threatens the use of water in the NRA for full body contact recreation. This type of water use includes swimming, water-skiing, and other similar activities during which water may be ingested accidentally and certain sensitive body organs (e.g., eyes and nose) may be exposed to water. Although water quality standards have been established for full body contact recreation for various physical water quality characteristics (e.g., temperature and turbidity) and trace

substances (e.g., arsenic, cadmium, and mercury), the critical water quality parameter for full body contact recreation in Lake Mead NRA is the level of fecal coliforms. The allowable maximum limits for fecal coliforms (in units/100ml) for full body contact recreation in the Arizona and Nevada water quality standards are 200 as a geometric mean (5 sample minimum), 400 in 10 percent of samples for a 30-day period; and 800 in a single sample.

Elevated counts of fecal coliforms generally occur during heavy use days (such as Labor Day), when lake levels are low, and at undeveloped coves accessible only by water where use is low to moderate and no sanitary facilities are available. In the latter case, localized incidents of high fecal coliforms occur when water levels rise and such areas are inundated. It should also be pointed out that bacteriological pollution is rare in open areas (such as Boulder Beach) where wind and wave action provide adequate mixing; however, in areas where beaches are located in harbors or confined areas, incidents of elevated coliform counts are common by late summer. For example, fecal coliform levels have reached 1,200 at Cottonwood Cove, 1,100 at Temple Bar, and up to 24,000 in Las Vegas Bay (discussed in more detail below). It should be noted that water quality at designated swimming beaches in Lake Mead NRA is regularly monitored in accordance with applicable state and local health codes to identify unsafe water quality conditions.

The overall water quality at the lakes was the subject of the Arizona Clean Lakes Classification Study (1982) recently conducted by the state. The purpose of the study was to determine the water quality characteristics of all lakes in the state and prioritize them according to those lakes requiring quality restoration work. In the overall ranking of 56 lakes, Lakes Mead and Mohave ranked 48 and 47 respectively, i.e., they require little restoration work. In specific catagories such as Secchi disk visibility, chlorophyl a, phosphates, dissolved oxygen, and nitrogen/nitrates, both lakes ranked consistently high. This speaks well of water quality in the lakes especially when the amount of visitor use is considered. Lakes Mead and Mohave ranked first and third respectively for overall recreation visitor days.

The Las Vegas Wash and Bay area has been a water quality problem on Lake Mead for a number of years. This is principally caused by the use of the wash as an outflow for municipal and industrial wastewater from the metropolitan Las Vegas area. In cooperation with Clark County, the state of Nevada, University of Las Vegas, Nevada, and the Environmental Protection Agency, the problem has been regularly monitored and studied since the early 1970s to assess the impacts on the lake and to work with pollution sources to find mitigating measures. The situation is especially critical because this area of the lake receives heavy visitor use and is the source of water for the Southern Nevada Water Plant and BMI. In the 1977 monitoring program report produced by UNLV and submitted to the Clark County Sanitation District, it was established that this is a localized incident that does not influence water quality on the rest of the lake or in Lake Mohave, primarily due to the dilution that occurs in the Boulder Basin. The problem has improved significantly. The Clark County Sanitation District has recently completed a new tertiary sewage treatment plant that is now operational. Industrial waste evaporation ponds in

Henderson, Nevada, which have been monitored as a possible pollution source, are currently being lined to prevent the percolation of contaminants into the groundwater table.

Another water quality problem common throughout the lower Colorado River is the increasing salinity levels. The salt is picked up naturally through groundwater. Water from the lower Colorado is used extensively for irrigation in the southwest United States and Mexico, and high salinity levels have a devastating effect on crops. The Bureau of Reclamation is currently studying the problem and a report is forthcoming.

## AIR QUALITY

The air quality of the Lake Mead region is generally good, especially in the Colorado Plateau portion of the recreation area. However, air quality degradation is increasingly evident throughout the lower elevations of the Basin and Range province. Air pollutants drain into the basin of the Colorado River from all directions and are of particular concern during periods of atmospheric inversion.

The major existing source of air pollutants within the recreation area is the coal-fired Fort Mohave steam generating plant of Southern California Edison Company, about 2 miles from the extreme southern park boundary in Clark County, Nevada. Pollution generated in the Las Vegas Basin west of the recreation area drains into the Boulder Basin along Las Vegas Wash. The automobile is the major generator of this pollution; however, the Henderson Industrial Park, 7 miles to the west of the recreation area, provides a local source of industrial pollution from chemicals, metal processing, and cement production. Other regional sources of pollution include the coal-fired power plant at Moapa, Nevada, about 15 miles northwest of the Overton Arm of Lake Mead; gypsum and some mineral processing plants north of the Boulder Basin; and dust from areas where the desert environment has been disturbed. Under appropriate atmospheric conditions, photochemical oxidants from the Los Angeles Basin are a major source of air pollutants. Since monitoring began in 1977 there has been a decline in air quality.

Background air quality data are not available for the recreation area; therefore, the impact of pollution on the ambient air quality cannot be quantified. However, a 1973 emissions inventory for Clark County, Nevada, carried out by the Air Pollution Control Division of the District Board of Health of Clark County, indicates that motor vehicles are the major contributors to air pollution in the county by accounting for 97 percent of the carbon monoxide, 81 percent of the hydrocarbons, and 52 percent of the nitrogen oxide emissions. Power plants discharge 89 percent of the sulfur dioxides and 22 percent of the total particulates. Mobile sources account for approximately 245,000 tons of pollutants in the air per year, power plants 83,000 tons, and industrial processes 56,000 tons.

The National Park Service is currently monitoring the visibility at Lake Mead through the use of a teleradiometer and camera. This data will be used to establish baseline air quality information.

## VISUAL QUALITY

Visitors at Lake Mead find spectacular scenic vistas from the park roads, lake surface, and hiking routes. Because the desert vegetation tends to be low and sparse, the views are uninhibited for miles. Striking backdrops for all recreational activities include deep canyons, dry washes, sheer cliffs, distant mountain ranges, the lakes, colorful soils and rock formations, mosaics of different vegetation, and changing cloud formations. A panorama of such intriguing features depends on clean dry air and is one of the most important resources in the recreation area.

Preserving the high visual qualities of the area is integral to preserving the high quality of the recreation experience. This is one reason why the National Park Service is so concerned about surface ground disturbance from mineral, oil, and gas leasing; illegal ORV use; and uncontrolled expansion of developed areas.

## SIGNIFICANT NATURAL FEATURES

Throughout the recreation area there are many natural features that are important enough to require special attention when considering any planning proposals. These include resources in the outstanding natural features and protected natural area subzones (see "Management Zoning" section); rare, threatened, or endangered species habitat; and areas important for visitor use and appreciation. Uniqueness, critical habitat protection, and aesthetic or recreational value are the criteria for outstanding natural features. Examples of outstanding resources are warm springs, unique geologic formations and plant communities, scenic vistas, bighorn sheep lambing grounds, and coves that are popular for their sandy beaches or scenic beauty. These features are identified on the Outstanding Natural Features map and were considered environmental constraints when evaluating development proposals.

Lake Mead affords special protection to some areas or features by including them in special natural area subzones. Starting south on Lake Mohave and moving north, these areas as numbered on the graphic include

1. Mouth of Grapevine Canyon - northernmost occurrence of smoke trees (Dulce Psabothamnus sp.) in the United States and only stand in the recreation area

2. Newberry Mountains - unique and scenic geologic formations in the Christmas Tree Pass and Spirit Mountain areas

3. Cholla Forest - unique, dense stand of teddy bear cholla cactus straddling the boundary north of the Cottonwood access road

4. Palo Verde (Cereidium) Forest - northernmost natural occurrence of palo verde trees in the United States and only stand in the recreation area

5. Fire Mountain Area - unique and scenic geologic formations of volcanic origin permeated by very colorful Andesitia flows

6. Black Canyon of the Colorado River - unique geologic and significant scenic values, with numerous hot and warm water springs and winter habitat for bald eagles

7. Fortification Hill/Paint Pots - unique and scenic geologic examples of volcanic activity and erosion

8. River Mountains - desert bighorn sheep lambing grounds and habitat (most productive herd in Nevada)

9. Redstone - unique and scenic geologic formations of aztec sandstone

10. Boulder Canyon - unique geologic and significant scenic values

11. Pinto Valley - unique and scenic geologic mix of smooth aztec sandstone and jagged granite outcrops demonstrating the mountain building geologic process of tilting

12. Rogers and Bluepoint Springs - unique warm water springs

13. Stewarts Point Area - unique salt deposits close to the surface or exposed and habitat for rare bearpaw poppy

14. Overton Wildlife Management Area - protected aquatic habitat area managed by the state of Nevada

15. Gypsum Beds - unique and scenic crystaline gypsum formations and wintering bald eagle habitat

16. Iceberg Canyon - unique and scenic geologic formation demonstrating tilting and unique distribution of ocotillo cactus

Wintering bald eagle sightings within the recreation area have increased in the last few years. Although isolated sightings have been made in areas, such as Swallow Bay and the Overton Wildlife Management Area, the heaviest concentrations seem to be along the Black Canyon between Eldorado Canyon and Hoover Dam and along the gypsum bed shoreline between Temple Bar and Bonelli Bay. Because this endangered species is only known to winter but not nest in the recreation area, the chances of conflict with heavy summer visitor use are minimal. However, facilities that would encourage increased winter visitor activity should be discouraged. The gila monster is listed as a species of concern by the states of Nevada and Arizona and currently under review for an official listing by U.S. Fish and Wildlife Service, but more data needed. The species has a habitat that generally includes the entire Mojave Desert, a large part of the recreation area. Sightings have been made in many areas, but the majority occur in the Katherine area and along the Northshore Road between the Echo Bay and Overton Beach access roads. Also listed as a species of concern by both states and under review by the U.S. Fish and Wildlife Service is the desert tortoise. The habitat for

the tortoise encompasses most of the recreation area, and sightings do not seem to be concentrated in any one area. The bonytail chub is known in the wild in Lake Mohave, one of the only places for this species in the United States. The Arizona Department of Game and Fish and the Bonytail Chub Recovery Team intend to use two coves across the lake from Cottonwood Cove to introduce fingerlings into their natural habitat.

Although there are no federally listed plant species that occur in the recreation area, there are six species known that are under review for listing by the U.S. Fish and Wildlife Service and/or species of concern in both Arizona and Nevada. These species and their locations within the recreation area are in appendix B.

Desert bighorn sheep are significant because of their value as a game species and as a species that many visitors enjoy viewing. Important desert bighorn sheep habitats and lambing grounds are identified on the Outstanding Natural Features map. This native species is making a strong population recovery within the recreation area primarily because its habitat requirements have, for the most part, not been compromised by development or bisected by roads.

Nearly 300 identifiable, named coves are on Lake Mead and about 200 on Lake Mohave. Some of these coves are not well suited for any activities while others may be suitable for only one or two activities. Of the 500 coves, only 12 are considered excellent for houseboating, beach camping, and waterskiing, three of the primary activities at Lake Mead. These coves were identified during the 1979 Carrying Capacity Study for both lakes by a team that visited every cove and rated the physical characteristics contributing to the coves' desirability. The activities and characteristics of the coves are as follows:

| Houseboating | Waterskiing | Camping |
|---|---|---|
| Soft ground-sandy beach | Steep dropoffs | Shade |
| Steep dropoffs | Sandy beach | Sandy beach |
| Sheltered cove | Sheltered | Visual screening |
| Lack of hazards | Sufficient size | Sheltered |
| | Lack of hazards | Flat area |

The following coves are most desirable for recreational use:

| Lake Mead | Lake Mohave |
|---|---|
| Road Runner | Davis |
| Sandy | Chili Pepper |
| Calico Bay | Cottontail |
| Bluepoint Bay | Owl Point |
| Faltons Reef | |
| Kline Hole | |
| Glory Hole | |
| North Bay | |

The few coves that have such high desirability ratings have been included as outstanding natural features. The planning process must consider the competition for, traditional use, and accessibility of these resources when making proposals. In some cases it may be advantageous to enhance the coves and in others it may be best to avoid them entirely.

Consideration of significant natural features must go beyond protecting the integrity of the feature itself. The spectacular views these features provide from points around the recreation area must also be considered. For example, the Newberry Mountains have been protected by zoning and their unique geology and scenic value recognized. However, to place a facility or a road scar outside the zone but in the foreground of the view as seen from the heavily visited Katherine developed area would detract from the overall scenic value of the mountains. Likewise, to make development around the Black Canyon visible from U.S. 93 on the Arizona side would compromise the scenic integrity of the canyon. Therefore, these and the following outstanding views as shown on the Outstanding Natural Features map are also constraints to be considered during the planning process.

Newberry Mountains viewed from Katherine area

Black Canyon viewed from U.S. 93

View corridor from Colorado River through Black Canyon

Fortification Hill/Paint Pots viewed from Boulder Beach area

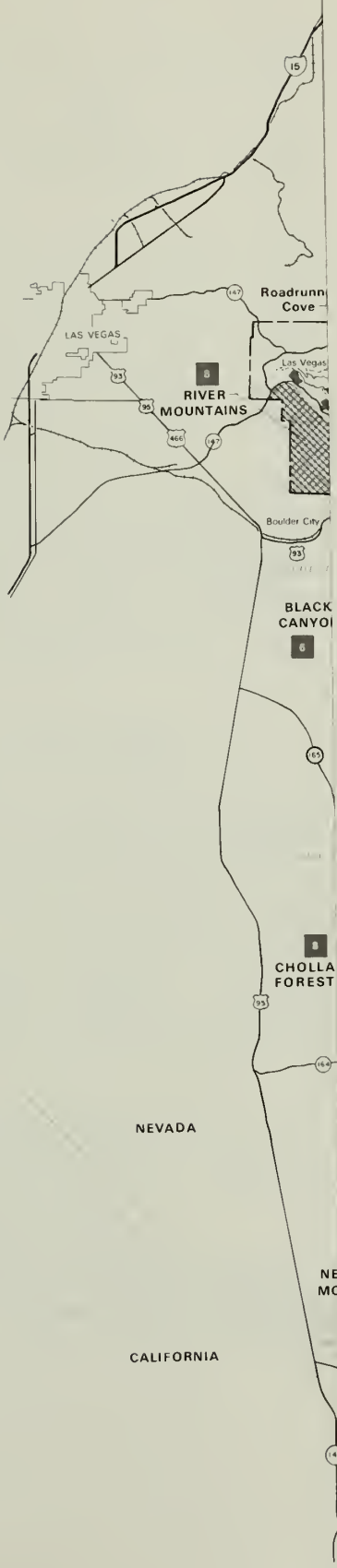
View corridor from Northshore Road between Callville and Echo Bay access roads

The Temple viewed from Temple Bar area

View corridor from water through Iceberg Canyon

Temple and Virgin Basin viewed from Pearce Ferry Road near Meadview

Grand Canyon viewed from rim of Shivwits Plateau




SIGNIFICANT NATURAL FEATURES

BIGHORN SHEEP HABITAT

* OUTSTANDING COVE

★ SPRINGS

VIEW

17 NUMBERS KEYED TO TEXT

N

5 0 5 10 15 MILES

5 0 5 10 15 20 KILOMETERS

# SIGNIFICANT NATURAL FEATURES

## LAKE MEAD NATIONAL RECREATION AREA

ARIZONA · NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

602 | 20,038D
DEC 84 | DSC


# SIGNIFICANT NATURAL FEATURES

## LAKE MEAD NATIONAL RECREATION AREA

ARIZONA · NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR
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602 | 20,038D
DEC 84 | DSC

# CULTURAL ENVIRONMENT

## ARCHEOLOGICAL RESOURCES

The Lake Mead area has been the subject of extensive archeological, anthropological, and ethnographical studies. Early 20th century research was primarily conducted by private institutions, while work from the 1930s to the 1960s was primarily government-funded and related to the creation of Lakes Mead and Mohave. More recent work has been carried out in conjunction with management of cultural resources at Lake Mead.

Many of the archeological resources now lie beneath the waters of Lakes Mead and Mohave. Still, over 800 archeological sites have been identified above the waterline, and researchers estimate that a complete survey of the recreation area would produce some 2,000 sites. To avoid the loss of archeological resources because of visitor use and development, research priorities in recent years have concentrated on the developed areas near the lakeshores. The backcountry and wilderness areas have been less extensively surveyed.

Four archeological complexes currently listed on the National Register of Historic Places are the Grand Wash archeological district, LAME Site 79A-1 (Echo Bay), the Overton Beach archeological sites, and the Lost City archeological sites. In addition, the Grapevine Canyon petroglyphs and the Salt Cove Saltmine are in the process of being nominated to the National Register.

## HISTORIC RESOURCES

Many of the historic sites of the Lake Mead area, such as early river crossings and ferries, townsites, and mines, are now submerged beneath the waters of Lakes Mead and Mohave. Currently no historic sites within the recreation area are on the National Register of Historic Places. However, on the basis of recent research, eight historic sites and one historic archeological site are now in the process of being nominated to the National Register. For the purposes of this plan, the following nine sites, which illuminate various aspects of Lake Mead's historic past, are considered to be of National Register significance:

Copper Mountain Mine
Homestake Mine
Grand Wash-St. Thomas Road
Scanlon Dugway
Waring Ranch
Ringbolt Rapids
Quartette Mining Company Railroad Grade
U.S. Government Railroad Grade
Willow Beach Gaging Station

Lake Mead has 38 structures included on its List of Classified Structures; 23 are associated with the National Register sites listed above. The remaining 15 structures are associated with the Golden Mile Mine, Golden Gate Mine, Joker Mine, Pearce Ferry Seismograph Station, Pine Valley Cabin, Tassi Ranch, Bonelli Ferry Road, Pearce Ferry Road, and the Six Companies Railroad Grade. All of these latter sites were evaluated by NPS historians in 1982 and were not considered to possess National Register significance.


MAJOR DEVELOPED AREA

EXISTING IMPROVED ACCESS POINT

N

5 0 5 10 15 20 MILES

5 0 5 10 15 20 25 30 KILOMETERS

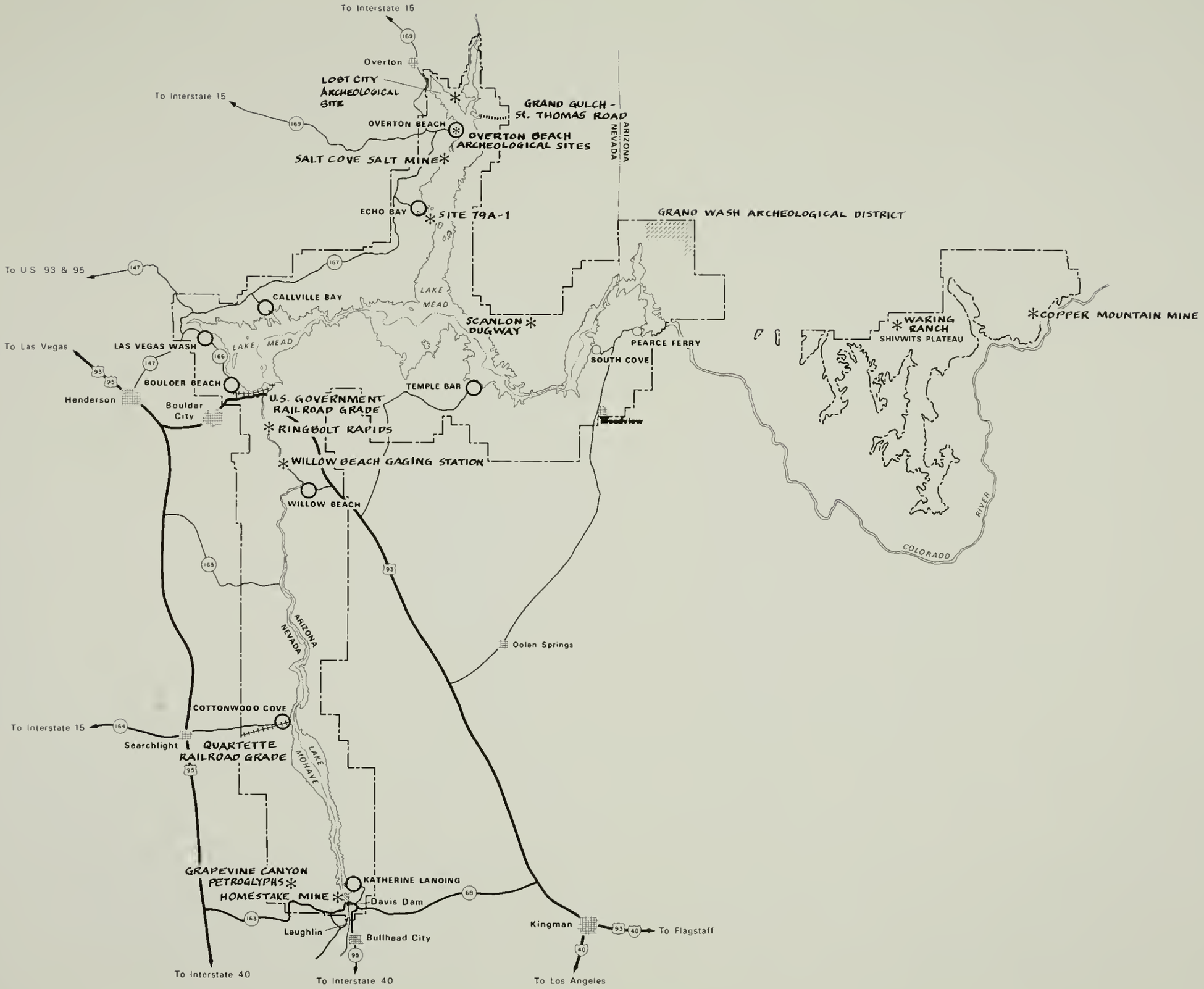
# * CULTURAL RESOURCES

## LAKE MEAD NATIONAL RECREATION AREA

ARIZONA - NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

602 | 20,035 C
DEC 84 | DSC




# * CULTURAL RESOURCES

## LAKE MEAD NATIONAL RECREATION AREA

ARIZONA - NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

602 | 20,035 C
DEC 84 | DSC

# SOCIOECONOMIC ENVIRONMENT

## REGIONAL LANDOWNERSHIP

Lake Mead NRA's immediate socioeconomic environment consists of a region composed of Clark County, Nevada (5,039,360 acres), and Mohave County, Arizona (8,458,880 acres). Landownership patterns in the two counties and in the composite region are shown on diagrams at the end of this section.

As elsewhere in both Nevada and Arizona, a very large proportion of the land in Lake Mead's region is owned and administered by the federal government (78%), with BLM being the largest administrator in both counties. Some 10 percent of the lands in Clark County and 11 percent in Mohave County are administered by the National Park Service. Nineteen percent of the composite region is in private, state, or local government ownership, ranging from 8 percent in Clark County to 25 percent in Mohave County.

## REGIONAL LAND USE AND SOCIOECONOMICS

As a composite, the region of Clark and Mohave counties has a population density of 24.6 persons per square mile. However, the two counties differ markedly in population density because of the influence of the Las Vegas urban area, which brings Clark County's figure to 58.8 persons per square mile, compared to Mohave County at 4.2 persons per square mile. Some 85 percent of the two-county population lives in Las Vegas.

Although a full spectrum of land uses takes place in the region, the predominance of federally owned land has led to primary public uses of recreation, power generation, and leased lands for mineral extraction and grazing. On private lands adjacent to recreational lands, increasing development of residential retirement and second homes is occurring, along with privately developed commercial facilities serving the recreational public.

The regional population has shown dramatic increases of an average of 12 percent annually from 1960 to 1980, with a total increase of 240 percent over the 20-year period. This growth is principally related to migrations into the Las Vegas urban area, which accounted for almost half the region's increase. However, substantial growth was also recorded within the rural and small town areas immediately surrounding Lake Mead.

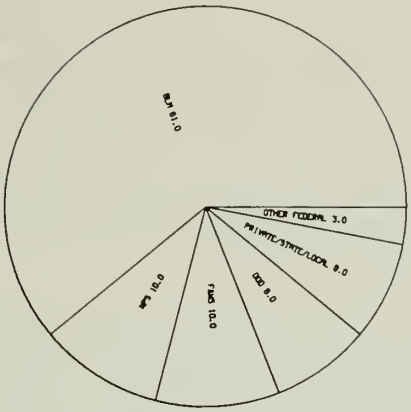
Per capita income in 1980 was $6,673 in Mohave County and $8,453 in Clark County, compared to $7,313 nationally. Regional unemployment has been running slightly lower than the national average. For 1980 the national unemployment average was 6.6 percent, while unemployment in Clark County was 3.1 percent and Mohave County was 5.4 percent.

The economy of Las Vegas is dominated by the gambling and entertainment industries, which attract over 12 million visitors annually. Elsewhere in Lake Mead's region, local economies depend heavily on

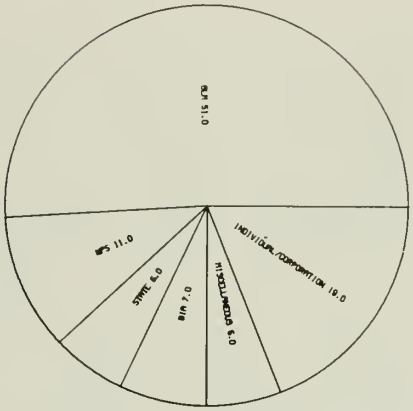
tourism and recreation-oriented activities, with Lakes Mead and Mohave being the principal recreational destination. Mining and minerals extraction and grazing are locally significant economic contributors, as are federal employment and power generation and export.

Laughlin, Nevada, across the Colorado River from Bullhead City, is a rapidly expanding gambling and entertainment center. In 1980 its population was 92, but its population is anticipated to reach 25,000 by 1990 (personal communication with Laughlin Chamber of Commerce).

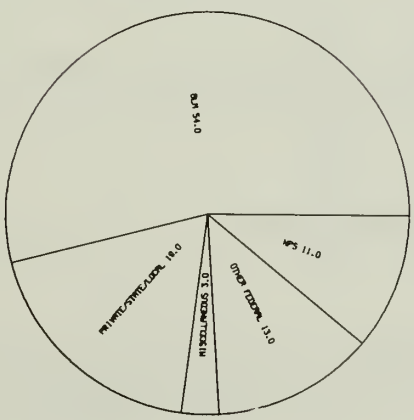
Clark County
Landownership




Mohave County
Landownership




Region
Landownership



## VISITOR USE ANALYSIS

Lake Mead NRA reports the number of recreational and nonrecreational visitors on a monthly basis. Use is measured in terms of visits, defined as the entry of a visitor into the park. Nonrecreational use is figured as commuters, inholders, tradesmen, and employees of any federal (not National Park Service), state, or local agency or business in the park as measured by traffic counters. Recreational visitors are counted at 22 to 29 different traffic counter locations at the recreation area, primarily at entrances to developed areas and primitive access points.

A visitor use study was conducted in 1978 and 1979 by the National Park Service. The surveys were conducted through a nonstatistical random sample, with the goal being the most responses possible. The questionnaires were handed out at developed areas and the visitor center; respondents were requested to return the completed survey by mail. The sample population was comprised of approximately 6,470 visitors, yielding a total of 1,585 respondents.

## REGIONAL RECREATION PATTERNS

The two-county region contains one national recreation area, a portion of a national park, one national forest, and two state parks. These units vary from arid canyonlands to forested mountains, and recreational opportunities range from hiking and boating to snow-skiing. Camping is available on federal lands and at many private campgrounds.

The principal scenic and recreational attractions are the lower portions of the Colorado River in Grand Canyon National Park and the Lake Mead National Recreation Area. The recreation area reported 6,128,254 recreational visits in 1983. The majority of these visitors considered Lake Mead to be their destination, with no other stops on their way to or from the area.

The typical visitor to the recreation area comes as a member of a family group and spends one night, resulting in one to seven days at the area within a year's time.

## RECREATION AREA USE PATTERNS

### Visitor Residence

As shown in the following pie chart, over one-third of the visitors surveyed in 1978 and 1979 were from southern California and one-fourth were from Las Vegas.

Residence
1978-1979 Visitors


## Visitor Activities

The region's climate facilitates year-round recreation at Lake Mead. Beach use and water sports are greatly limited during the winter, but the best lake fishing occurs at this time, and the increase in the number of fishermen tends to offset the decrease in the number of other kinds of recreationists. Hot summertime temperatures tend to discourage backcountry use west of the Grand Wash Cliffs, and most of the summer recreation in this part of the recreation area occurs on or near the lakes. The cooler climate of the Colorado Plateau, east of the cliffs, tends to favor use of the backcountry in this area during the summer, but physical isolation and poor roads have limited such use.

Park visitors participate in the following activities in the proportions shown below:

| | | | |
|---|---|---|---|
| 97% | relax | 64% | water ski |
| 93% | view scenery | 33% | rock hunt |
| 89% | swim | 19% | attend evening programs |
| 80% | camp | 11% | sail |
| 77% | picnic | 10% | four-wheel |
| 76% | motor boat | 8% | dirt bike |
| 76% | hike/walk | 8% | scuba dive |
| 73% | photograph scenery | 6% | backpack |
| 70% | fish | 3% | hunt |

A majority of visitors have indicated a desire to see new areas developed in the recreation area, although there was no concensus on location(s).

## Visitation Patterns

The peak use days of the year usually occur during Memorial Day weekend. In 1983, there were about 253,791 visitors (33% increase over

1982) during the three-day period. Labor Day weekend and the Fourth of July weekend fluctuate on being the second highest peak day; in 1983, the three-day period for the Fourth of July had 162,928 visitors (36% increase over 1982), while the four-day Labor Day weekend had 121,887 visitors. The majority of these visitors are in the Lakeshore Road (Boulder Beach and Las Vegas Wash) and Katherine areas. The Lakeshore Road area tends to attract day users, while Katherine attracts more overnight visitors.

Through 1983 April/May and July/August are the peak use periods as shown in the Monthly Visitation graph. About 50 percent of the total year's visitation occurs from April through August, with 75 percent occurring from March through October. Visitation at the developed areas has been relatively uniform over the last five years (see Visitation by Developed Area graph). Likewise, overnight stays at concession lodging have not changed significantly over the last five years (see Concession Lodging graph). From 1979 to 1982 there was a +0.3 percent growth per year in overnight stays at concession lodging. This static trend is expected to continue in the near future or occupancy could increase if any number of factors change. Specific events can alter this trend. In 1983 use of concession lodging decreased, but it is attributed to the recession and extreme high water levels on Lake Mead. It is noteworthy that while use of overnight facilities decreased in 1983 compared to 1982, total visitation increased. People came to see the lake flowing over the Hoover Dam spillways, but due to the recession and concern over dam failure they did not stay overnight as often as in 1982. The trend from 1979 to 1982 for all other overnight stays (NPS and concession campgrounds, trailer villages, and RV sites) in developed areas was a +2 percent increase. Again 1983 was left out because of the specific events that decreased the use of facilities.

Occupancy rate information would be very useful for determining facility use trends, but such data are not available for Lake Mead.

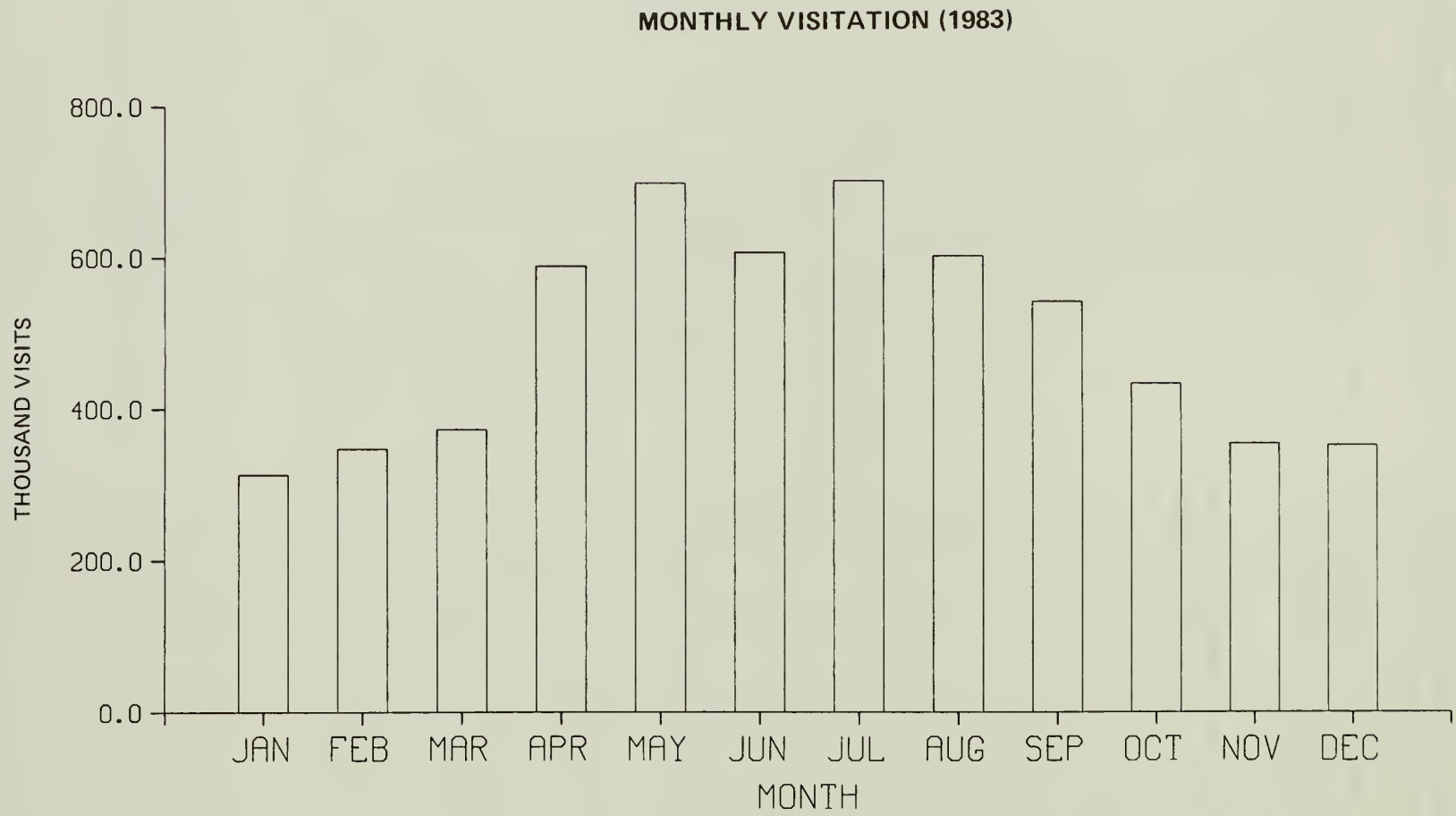
Facility use is dependent on the economy, quality of the facilities and associated services, price, and quantity of available facilities. Nearly static use, as observed for overnight stays at concession lodging, can result from one or more factors, and it is not known which ones are currently responsible. Since the use of the less expensive overnight options (campgrounds, trailer villages, and RV sites) increased during the same time frame, lodging costs and the state of the economy may be the cause for the near static use of concession lodging.

Discussing trends with only a few years worth of data may be misleading. A more realistic evaluation of visitation trends at Lake Mead can only be made by looking at visitation over the long term, which is not possible at this time for overnight stays because of the inconsistency of existing data. The overall visitation trend gives a clearer picture of the potential use of facilities, depending on the types of factors discussed previously.

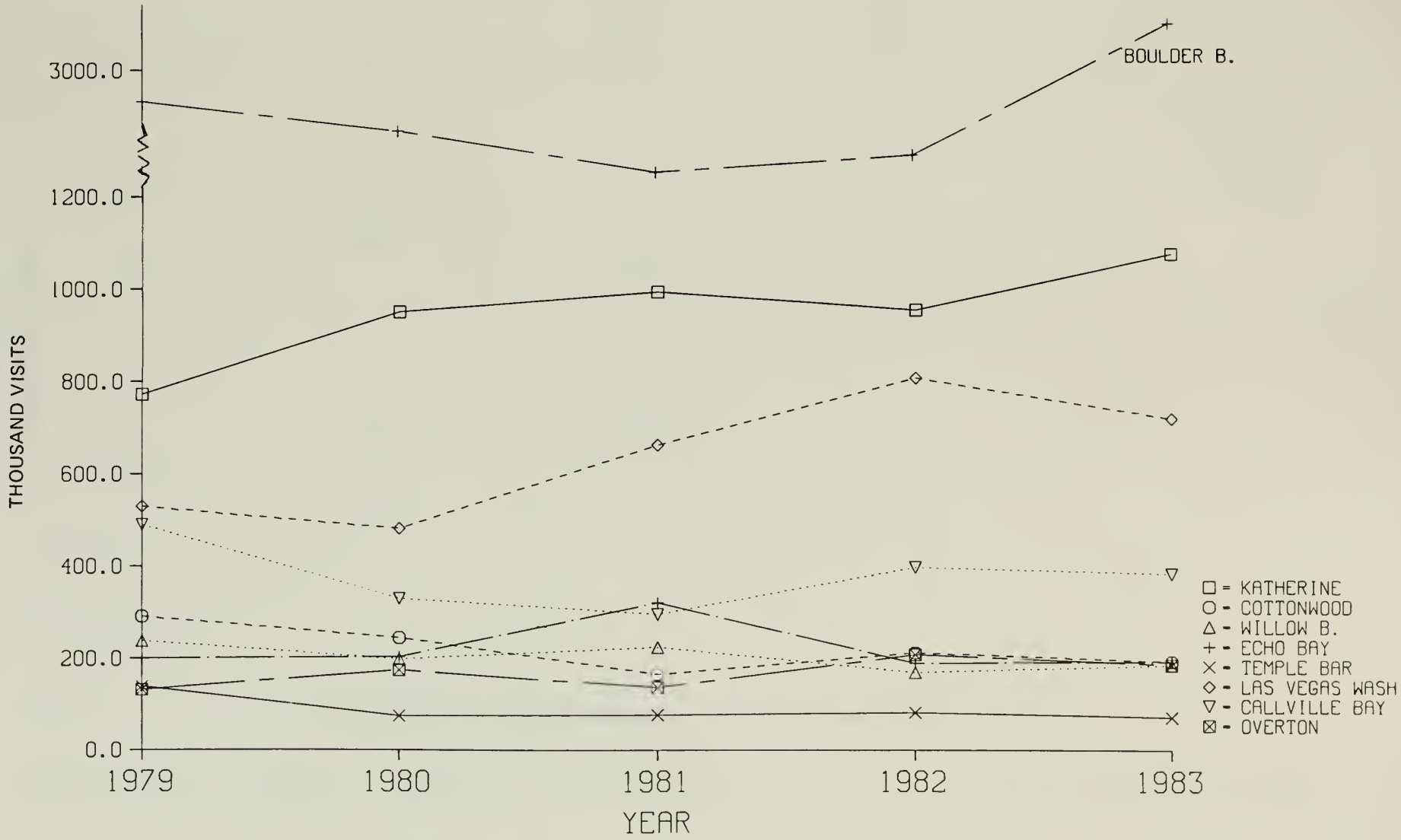
Since the mid 1940s, visitation to Lake Mead has increased fairly steadily (see Visitor Use Levels graph). The growth rate from 1962 through 1983 averaged 156,343 more visits each year. Growth during the last decade has not been unduly affected by gasoline shortages in 1974 and 1979.

Because a large portion of the visitors are from Las Vegas and other close areas, they will tend to continue visiting Lake Mead in times of gasoline shortages.

Future trends in visitation to Lake Mead National Recreation Area can be projected by observing the trends in the past two decades (see Projected Growth graph), especially as the major urban areas it serves are continually growing. The line labeled "continued growth" is a projection based on visitation from 1937, while the line labeled "back to 1962" reflects growth potential, considering only the more recent years when growth in the region expanded.


MONTHLY VISITATION (1983)
800.0
600.0
400.0
200.0
0.0
THOUSAND VISITS
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
MONTH

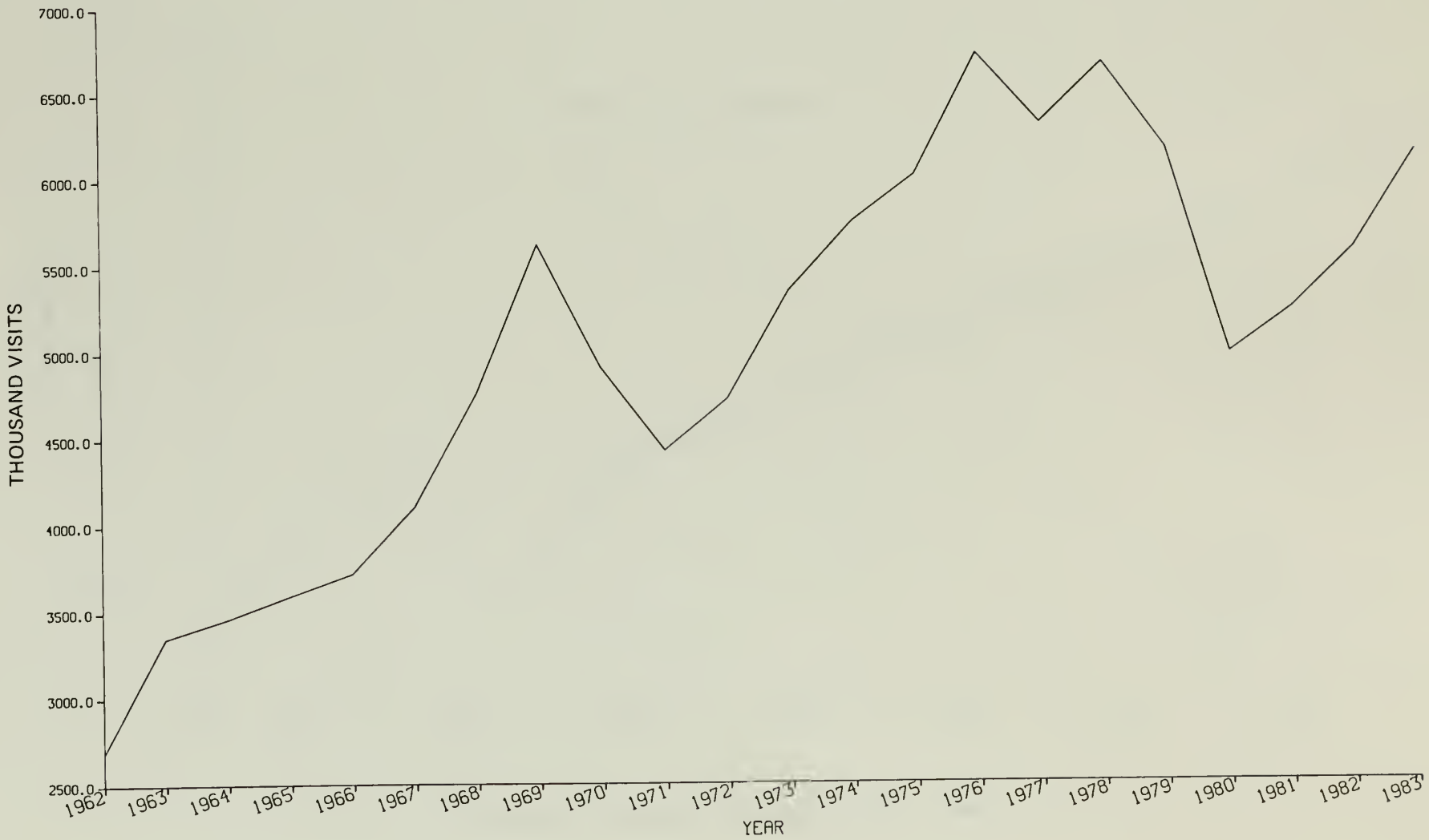
## LAKE MEAD NRA VISITATION BY DEVELOPED AREA (1979 - 1983)



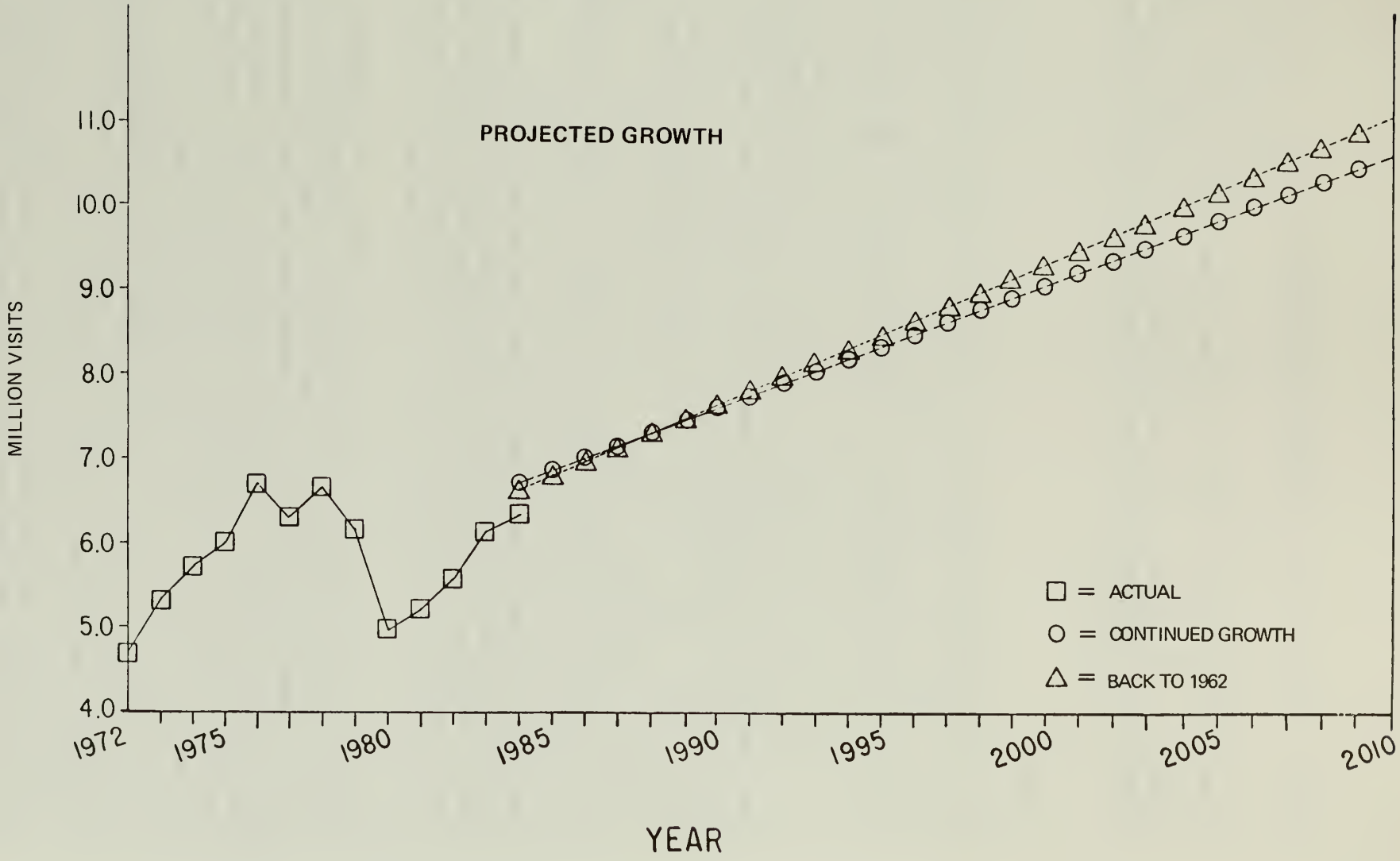
## LAKE MEAD NRA CONCESSIONER LODGING (1979 - 1983)


* Correct 1981 data unavailable

## LAKE MEAD VISITOR USE LEVELS (1962 - 1983)



## LAKE MEAD VISITOR USE LEVELS (1937 - 1961)


PROJECTED GROWTH
MILLION VISITS
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
1972
1975
1980
1985
1990
1995
2000
2005
2010
YEAR
□ = ACTUAL
○ = CONTINUED GROWTH
△ = BACK TO 1962

## FACILITY ANALYSIS

A full description of existing facilities can be found in the "Alternative Development Concept Actions" section under the no-action alternative column of the actions chart. Following is a discussion of roads and utilities, which are more clearly explained in the Actions chart. However, an understanding of access and utilities are basic to all development proposals.

### ROADS

The major paved and dirt roads that are primarily used by visitors are part of this facility analysis.

Nevada 163 and Arizona 68 is the major paved road in the southern portion of the recreation area, which connects U.S. 95 with U.S. 93. It is a two-lane road that has considerable use because it is one of the only crossings of the Colorado River. This road is maintained by Nevada. The other major road through this portion of the recreation area is U.S. 93, a major two-lane highway connecting Phoenix to Las Vegas. This state-maintained road has three pullouts, with one overlooking Willow Beach and the Colorado River.

Other paved roads around Lake Mohave include the access roads to Katherine Landing (3 miles), Willow Beach (4 miles), Cottonwood Cove--NV 164 (5 miles), and NV 165, which terminate at a Colorado River overlook/turnaround above Eldorado Canyon. These roads within the NRA boundary are maintained by the National Park Service.

The area around Lake Mohave has two major dirt roads that are maintained by the National Park Service after entry into the recreation area's boundary. They are Christmas Tree Pass Road (9 miles) and Cottonwood Cove East Road (4 miles). The Christmas Tree Pass Road has two turnouts for interpretation and an area designated for camping.

Within the Boulder Basin area are three major paved roads. U.S. 93 bisects the lower portion of this district and crosses Hoover Dam. This highway is maintained by the state and is a major southwest connecting route. Lakeshore Road, which is maintained by the Park Service, runs from a junction with U.S. 93, traverses 14 miles, and then terminates at Henderson, Nevada. Northshore Road begins at a junction with Lakeshore Road and terminates north of the recreation area's boundary in the town of Overton. This 64-mile-long road is maintained by the Park Service within the boundary. Lake Mead Boulevard (6 miles), the access road to Callville (4 miles), and the access road to Hemenway launch ramp (1.5 miles) all begin or terminate on one of the previously mentioned roads that the Park Service maintains and services.

In other parts of the recreation area access is provided to Temple Bar, of which the Park Service maintains 14 miles; and to South Cove launch ramp, of which the Park Service maintains 13 miles. This road begins at a junction with U.S. 93 and goes through the town of Dolan Springs to the NRA boundary.

Three major dirt roads are maintained: Temple Bar to Gregg's Hideout Road (34 miles); Gregg's Hideout access road (8 miles); and Pearce Ferry access road (3 miles).

## UTILITIES

The following discussion describes the utility systems that are currently provided at developed areas throughout the recreation area.

### Katherine Landing

This area has a 500,000-gallon water storage tank and a treatment system that distributes water to the developed area. The water is taken out of Lake Mohave and pumped to the treatment facility. The sewage system consists of three lagoons that treat the sewage. The power and telephone system is provided by Citizen's Utility Company of Kingman, Arizona.

### Cottonwood Cove

California Pacific Power supplies the power to Cottonwood, and Centel of Las Vegas supplies telephone services. Cottonwood Cove has a three-cell sewage treatment facility and two wells that pump into a 325,000-gallon storage tank and treatment facility.

### Willow Beach

Two wells currently supply a 200,000-gallon water storage tank and treatment facility. The power and telephone are supplied by Citizen's Utility Company. Two lagoon cells provide the necessary sewage treatment. When the flood mitigation is completed, the water and sewage systems will need to be rebuilt.

### Boulder Beach Area

Within the Boulder Beach area all power is supplied by Nevada Power, and all telephone services are provided by Centel of Las Vegas. The sewage is treated by four lagoons. The water is pumped from Lake Mead into a treatment plant and distributed from a 2,455,000-gallon storage system.

### Las Vegas Wash

The water for this area is taken from a private pipeline and treated and then distributed from a 100,000-gallon storage tank. All sewage is treated through a three-cell lagoon system. The power is provided by Nevada Power, and telephone service is supplied by Centel Telephone System.

## Callville Bay

Telephone service for this area is provided by Centel Telephone. Nevada Power provides power, but it is inadequate. The water system at Callville Bay consists of water intake on Lake Mead, with a 100,000-gallon storage tank and a treatment and distribution system. Two cells treat the sewage generated at Callville Bay. This system must be redone to handle any future needs that may be generated.

## Echo Bay

Overton Power District and Moapa Valley Telephone supply utilities to this area. The water system consists of a lake intake system and a 601,000-gallon storage system. There is a four-cell sewage system at Echo Bay.

## Overton Beach

The Overton Power District and Moapa Valley Telephone supply utilities. The sewage is treated in a new four-cell treatment facility, and the water system consists of a water intake with a 165,000-gallon storage tank and a treatment pump.

## Temple Bar

Citizen's Utility Company of Kingman, Arizona, supplies the power and telephone service to Temple Bar. The water treatment consists of two wells that supply a 600,000-gallon storage tank and treatment system. The sewage is treated in a four-cell system, all of which are new and sized accordingly.

# ENVIRONMENTAL CONSEQUENCES

## INTRODUCTION AND DERIVATION OF IMPACT TOPICS

A summary of environmental impacts is presented in the "Summary" section at the beginning of this document. Impacts of the proposed action and alternatives are summarized there. As described in the "Management Strategy" section, many development proposals are the maximum allowable, rather than the optimum based on current or projected demand. The following environmental consequences evaluate the worst-case situation. The actual level of development would most likely be less than the maximums, so that the resultant impacts would be less severe than those described. All impacts take into account the trend of increasing visitation described under recreation area use patterns in the "Visitor Use Analysis" section, and the impacts would be greater or lesser depending on how actual visitation varied from the predicted trend.

The impacts that mineral leasing might have on other natural and cultural resources under the alternatives have not been assessed in detail because of the highly speculative nature of mineral resources within the recreation area. Specific impacts are outlined for the development of mineral commodities that can realistically be expected to be mined within the next decade. Impacts associated with the development of other mineral commodities are discussed in less detail because of the improbability of development.

To focus on the most significant impact topics, the issues, alternatives, and impacts were evaluated throughout the GMP planning process. The issues and alternatives are presented in the previous section, and the scoping process and its results are described in the "Consultation and Coordination" section. A few impact topics, like threatened and endangered species, were raised by the public in the scoping process. However, all impact topics were evaluated by the GMP planning team and narrowed to specific topics that include only those of significant environmental concern. An explanation of how each impact topic was generated follows.

| Broad Impact Subjects | Impact Topics |
|---|---|
| Floodplains | |
| Lake Meads' flash-flood zones are dry washes that lack ecological values which regulations intended to protect--no recharge of water tables, no diverse riparian environment, no wetland or riparian species, etc. There are some developments in flash-flood zones where people and property are jeopardized. | Public Safety in Floodplains<br>Property in Floodplains |

Floodplain capacity would not be affected by changes in development or even structural flood mitigation measures. The location of the flood flow could be altered, but the capacity would not change. Thus, floodplain capacity is not a significant issue.

Water Quality

Wind-induced wave action overrides all other sources of siltation. Salt or heavy metal concentrations are Colorado River Basin problems and do not stem from any GMP issues. Microbial contamination of lake water from human waste in areas of concentrated visitor use poses a problem.

Reservoir Water Quality

Wetlands

U.S. Fish and Wildlife Service lists no wetlands in Lake Mead. However, desert spring communities are critical wetland habitat in small isolated areas. They are not as critical for free-roaming animals as they once were, because those animals can also get water from the reservoirs. Only two springs are located where they might be affected by GMP development proposals. Others might be affected by mineral leasing. The riparian habitat along the Virgin River and Las Vegas Wash would not be affected by any GMP proposals

Desert Spring Ecological Communities

Soils

There is no parkwide information on soils, but what is known indicates no soils of inherent value--no farmland or productive soils, no rare soils. Most soils are unconsolidated alluvial material lacking soil profiles. Some soils with high shrink-swell properties could affect the development proposals. Because significant soils cannot be identified due to lack of data, a general analysis of impacts on soils will be presented.

Soils

Significant Natural Features

Unique, rare, scientifically important, or scenic natural features--see "Affected Environment" section for full listing. Many of these features are critical for their scenic or visual resource values. None affected except from potential mineral development.

Significant Natural Features

Vegetation

Most vegetation types are regionally common or are already disturbed by man. Accordingly, threatened or endangered species and desert spring communities (already considered) are the critical issues.

Development proposals are all in previously disturbed areas of the creosote bush community, which dominates almost three quarters of the recreation area. Mineral leasing could affect vegetative communities that are more significant. Thus, the impacts from mineral leasing on vegetation in general will also be considered.

Threatened or Endangered Species
Vegetation

Wildlife

Most species are regionally common. Desert bighorn sheep are important for viewing, hunting, and restocking of depleted herds in other areas; threatened or endangered species are important for their rarity and legally protected status.

Threatened or Endangered Species
Desert Bighorn Sheep

Visitor Use

Much of the plan is directed at managing visitor use. The major areas for potential impacts are cabin sites, trailer villages, and visitor crowding/congestion. Traffic levels, circulation, and congestion are serious concerns addressed under visitor crowding/congestion.

Visitor Crowding/Congestion
Vacation Cabin Site Residents
Trailer Village Residents

Impact on offroad vehicle use is not addressed because all use of vehicles off approved roads is illegal, and the current system of approved roads that can be used by offroad vehicles is not changed by any alternative.

Concession Operations

The level of services offered by concession operations directly affects visitor use and is therefore an important component of the Lake Mead environment.

Level of Concession Operations

Mineral Leasing

There is potential for major impacts on mineral leasing and development from zoning alternatives. The GMP addresses management of future mineral leasing. None of the alternatives affect existing mineral interests whether they arise from a valid mining claim, existing lease, or nonfederal mineral ownership. Based on what is known about mineral resources within the NRA, uranium appears to be the most probable mineral to be developed within the immediate future. Sporadic exploration for oil and gas may continue in the future; however, major field development is not expected and impacts would be minimal from the sporadic exploration activity. Exploration for other hard-rock minerals might occur in scattered locations, and some minor production might occur in older existing mines, but based on past trends no major new mines would be expected.

Mineral Leasing Opportunity

Wilderness Values

Lands meeting the criteria of the Wilderness Act have been identified. There is potential for major impacts on these lands from zoning alternatives.

Lands Possessing Wilderness Values

Air Quality

| | |
|---|---|
| Air quality problems are in a regional airshed from major population centers and power plants. Dust from dirt roads is not significant locally by comparison to regional problems. Although visitation is projected to increase, no proposals under any alternative could alter existing air quality. | Not Considered Further |

Cultural Resources

| | |
|---|---|
| As described in the "Affected Environment" section, all significant cultural resources have been identified. However, none of these would be affected by any development proposals. To ensure protection of any unknown cultural resources, preconstruction or premineral leasing surveys would be conducted for all land that could be affected by specific construction or leasing proposals. | Not Considered Further |

Land Protection Issues

| | |
|---|---|
| The GMP summarizes decisions already made in the Land Protection Plan and does not propose any new actions. The LPP had its own assessment. See the "Land Protection" section for a full description of the issues and management direction on<br><br>boundary revisions<br>state and private lands<br>Santa Fe Pacific mineral rights<br>Arizona indemnity selection program<br>Hualapai Indian Reservation lands<br>Bureau of Reclamation withdrawal lands<br>easements and utility corridors<br>special activities on nonfederal lands | Not Considered Further |

Resources Management Issues

| | |
|---|---|
| The GMP summarizes decisions already made in the Resource Management Plan and does not propose any new actions, except for mining/ minerals management and actions related to illegal use of vehicles off approved roads. The RMP had its own assessment. See the "Natural and Cultural Resources Management" section for a full description of the issues and management direction on<br><br>natural resources management<br>fishing, hunting, and trapping management<br>tamarisk control<br>exotic species control<br>air and water quality monitoring<br>fire management<br>threatened or endangered species management<br>grazing management<br><br>cultural resources management<br>cultural resource surveys<br>archeological site management<br>historic site management<br>contemporary native American concerns<br>collections management | Not Considered Further |

Public Safety on Highways

| | |
|---|---|
| The most dangerous road in the national park system and several others with high accident rates are in the recreation area. These issues and other road maintenance problems are being addressed by a separate planning process done in conjunction with the Federal Highway Administration. The GMP summarizes decisions made in this separate process. | Not Considered Further |

A summary of the following impacts is presented in the "Summary" section at the beginning of volume I.

## IMPACT ON PUBLIC SAFETY IN FLOODPLAINS

Many areas in the recreation area are subject to flash flooding. The 100-year flood has a 1 percent chance of occurring in any year. The probable maximum flood is the greatest flood that could ever be expected. Probable maximum floods do occur, but the frequency is uncertain; the likelihood in any year is less than 1/10 of 1 percent. Flooding is most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor use facilities are out of the floodplain. At Boulder Beach all development is on a broad alluvial fan, with protection provided by earth dikes. Flooding at Boulder Beach can concentrate unpredictably in localized flows but more often takes the form of sheet flows up to 2 feet in depth. Therefore flooding at Boulder Beach is not considered to present as great a danger to human life or property as the concentrated flows in canyons at other areas in the NRA, and no potential victims or damage to structures are shown for Boulder Beach under the impact sections relating to floodplains. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain. See the discussion of floodplains and wetlands in the "Affected Environment" section of this document for a more detailed explanation of floodplain conditions. The development concept plan graphics for each developed area show the extent of the 100-year and probable maximum floods.

The proposed action would mitigate the impact of floodwaters to the 100-year level with structural measures, mitigate the effects of floods larger than the 100-year flood with warning systems and evacuation plans, and rely on relocation of facilities for some areas. Removal of structures that would be used by people or relocation of the structures out of the floodplain provides the best protection. Structural measures offer the next best method. Warning systems provide less protection than either of the former two methods. The "Alternative Development Concept Plans" section of this document has full details on proposals. The discussion on floodplains and wetlands in the "Affected Environment" section describes flood probabilities.

The proposed action would involve implementation of nonstructural (not requiring major construction) flood mitigation measures in all developed areas having flood hazard. These measures are as follows:

Provide education and information about the potential flood hazard and what to do in case of such an emergency.

Install flood warning systems that provide early identification of an impending flood; analyze the magnitude, severity, and potential impact of an impending flood; disseminate appropriate warnings to parties likely to be affected by an impending flood.

Prepare evacuation plans. Evacuation planning for developed areas at Lake Mead is influenced by two factors. First, flooding can occur very rapidly, so people must respond rapidly to a warning to save their lives. Second, some of the developments are located such that safe refuge is either some distance away or difficult to reach because of steep slopes.

All three of these nonstructural measures are collectively referred to as the warning system package in the discussions that follow. Two developed areas, Willow Beach and Cottonwood Cove, already have warning system packages in operation.

The following is a summary of the most important structural measures that would be implemented under the proposed action. A complete discussion of flood mitigation actions for the proposed action can be found in the "Alternative Development Concept Actions" section.

Katherine Landing

one earth/concrete/gabion-lined diversion canal 1,550 feet long
concrete-lined channel 2,437 feet long
650-foot concrete-lined diversion dike

Cottonwood Cove

three concrete/gabion-lined diversion dikes totaling 1,700 feet in length
two concrete-lined channels totaling 5,911 feet in length

Willow Beach

550 feet of riprap dike
626 feet of concrete wall

Boulder Beach

armoring of existing earth dikes with gabions

Las Vegas Wash, Overton Beach

no structural measures

Temple Bar

four armored diversion dikes 2,595 feet long
two concrete channels with a combined length of 3,955 feet

Facilities that would be relocated out of the floodplain include:

Katherine - NPS maintenance
Cottonwood - NPS housing and maintenance
Willow Beach- NPS housing and maintenance, ranger station, campground, trailer village, concession housing and maintenance
Las Vegas Wash - dry boat storage, concession maintenance
Overton Beach - campground

Structural measures for protecting people and development are less effective than relocating the people and development out of the floodplain because the former rely on man-made attempts to change the shape of the natural floodplain into a configuration that is more convenient to man, and they must be adequately designed, constructed, and maintained to be effective. Sometimes structural measures provide the basis for a false sense of security to people in the floodplain, and people fail to evacuate the floodplain in case of potential flooding.

Warning systems provide the least protection of the three measures discussed. To be effective, warning systems must receive and interpret incoming data correctly and give the warning signal, the Park Service personnel must receive the warning signal and put the evacuation plan into effect. Occupants of the floodplain must then cooperate in getting to higher ground. There are no statistics available on the likelihood of a warning system failure. Some people might not receive the warning, and others might refuse to follow evacuation instructions. Thus, the possibility of injury or loss of life exists for the people in the greater than 100-year floodplain at the time of such a flood event.

Under the proposed action, structural measures would protect up to the level of the 100-year floodplain. Any flood greater than the 100-year flood would be mitigated by warning systems only.

Under the proposed action, on an average summer weekend, an estimated 160 people would be in the 100-year floodplain at any one time in the daytime and none would be there at night. For the possible maximum flood, the numbers would be approximately 4,155 for day and 3,860 for night. Of the 96,000 people expected to be in the recreation area on a summer weekend day, 0.2 percent would be expected to be in the 100-year floodplain and about 4 percent would be in the PMF. For the 100-year flood, these figures are 13 percent of the figures for a daytime flood and 0 percent of the number of potential victims for a nighttime flood. For the probable maximum flood, these figures are over 90 percent of the figures for existing conditions. The figures presented in the preceding narrative and in tables 23 and 24 are based on the number of people that would be expected to be in the floodplain at any one time on an average summer weekend day. The potential hazard to people in the probable maximum floodplain would be mitigated under the proposed action by warning systems, evacuation plans, and emergency procedures.

After all the mitigation measures were taken for the 100-year flood, there would be very few people in the floodplain. The hazard for them, as well

Table 23: Estimated number of people in the 100-year floodplain at any one time on an average summer weekend who would only be protected by warning systems and evacuation plans

| | No-Action Alternative (Same as existing conditions) | | Alternative A | | Alternative B | | Proposed Action | |
|---|---|---|---|---|---|---|---|---|
| | Day | Night | Day | Night | Day | Night | Day | Night |
| Katherine | 605 | 800 | 5 | 0 | 5 | 0 | 10 | 0 |
| Cottonwood | 100* | 30* | 0 | 0 | 25 | 0 | 0 | 0 |
| Willow Beach | 465 | 395 | 50 | 0 | 90 | 0 | 70 | 0 |
| Las Vegas Wash | 40 | 0 | 40 | 0 | 40 | 0 | 40 | 0 |
| Overton Beach | 40 | 0 | 40 | 0 | 40 | 0 | 40 | 0 |
| Temple Bar | 0* | 0* | 0 | 0 | 0 | 0 | 0 | 0 |
| NRA Grand Total | 1,250* | 1,225* | 135 | 0 | 200 | 0 | 160 | 0 |
| Percentage of Existing Conditions | 100% | 100% | 11% | 0% | 16% | 0% | 13% | 0% |

*The 100-year floodplain was mapped at Cottonwood and Temple based on the assumption that existing earth dikes and channels would withstand the 100-year flood. However, those structures are not likely to withstand such a flood, and the number of people in the floodplain for those areas and the grand total are unrealistically low. No attempt was made to estimate numbers of people in the floodplain because of dike and channel failures, because the sites of the potential failures and the extent of resulting inundation are too unpredictable.

Table 24: Estimated number of people in the probable maximum floodplain at any one time on an average summer weekend who would only be protected by warning systems and evacuation plans

| | No-Action Alternative (Same as existing conditions) | | Alternative A | | Alternative B | | Proposed Action | |
|---|---|---|---|---|---|---|---|---|
| | Day | Night | Day | Night | Day | Night | Day | Night |
| Katherine | 1,095 | 1,120 | 5 | 0 | 5 | 0 | 570 | 520 |
| Cottonwood | 1,735 | 1,590 | 0 | 0 | 280 | 0 | 1,830 | 1,825 |
| Willow Beach | 490 | 360 | 50 | 0 | 50 | 0 | 100 | 0 |
| Las Vegas Wash | 40 | 0 | 40 | 0 | 40 | 0 | 40 | 0 |
| Overton Beach | 315 | 550 | 40 | 0 | 40 | 0 | 40 | 0 |
| Temple Bar | 1,170 | 1,250 | 0 | 0 | 0 | 0 | 1,575 | 1,515 |
| NRA Grand Total | 4,845 | 4,870 | 135 | 0 | 415 | 0 | 4,155 | 3,860 |
| Percentage of Existing Conditions | 100% | 100% | 3% | 0% | 8% | 0% | 86% | 79% |

as people in the probable maximum flood, would be mitigated with warning systems and other methods. However, there would be little difference between the proposed action and existing conditions with regard to the number of people in the PMF. Examining each developed area explains this situation.

Under the proposed action, at the Katherine area approximately 630 people (daytime) would be protected from the probable maximum flood by prohibiting use of the North and South Telephone coves primitive use area and access and from other minor changes. An additional 105 people would be at risk from a daytime probable maximum flood compared to existing conditions at the expanded motel. The net result at Katherine is about 525 fewer people in the PMF.

At Cottonwood approximately 40 fewer people would be in the probable maximum floodplain in the daytime compared to the no-action alternative because of the relocation of NPS maintenance, NPS housing, the picnic area, and concession housing out of the floodplain. About 140 additional people would be in the probable maximum floodplain in the daytime compared to existing conditions because of expansion of the motel, restaurant, store, parking, dry boat storage, and concession maintenance. Here there would be about 100 more people in the probable maximum floodplain.

At Willow Beach approximately 200 fewer people would be in the probable maximum floodplain in case of a daytime flood because of relocation of NPS maintenance, the trailer village, and concession housing. About 170 people would be protected from a daytime flood by diverting floodwaters with structures. About 10 additional people might be in the probable maximum floodplain on an average summer weekend day at any given time because they would be using the new trailer dump station/gas station. Overall about 380 fewer people would be in the probable maximum floodplain.

At Boulder Beach aproximately 353 additional people would be in the zone of sheet flooding due to expansion of the campground, trailer village, motel, and store. Installation of a warning system would be the only protection afforded these people in the probable maximum floodplain. However, sheet flows of 1 to 2 feet in depth are not expected to be life threatening to many visitors.

There would be no change in the numbers of potential victims of the probable maximum flood at Las Vegas Wash.

At Overton Beach relocation of the campground would remove approximately 275 people from the probable maximum floodplain. This action would also be taken under the no-action alternative. The swim beach would remain, leaving some people in the floodplain. Accordingly, there is no difference between the no-action alternative and the proposed action.

Flood safety at Temple Bar would be improved over existing conditions by protecting two daytime residents from the probable maximum flood through diversion of floodwaters. An estimated 370 additional people would be at

risk from a daytime probable maximum flood because of expansion of the parking, motel, restaurant, and store. The net change here would be about 370 more people being in the floodplain under the proposed action.

The number of people in the 100-year floodplain would be greatly reduced under the proposed action compared to existing conditions (160 compared to 1,250). There would be a net decrease in the number of people in the probable maximum floodplain because the number of people protected through site closures or relocation of structures would more than offset the increased number of people in the probable maximum floodplain because of expansion of facilities. The decrease in the number of people in the probable maximum floodplain would be about 365. However, this is a small 8 percent reduction, and about 4,155 people would still be estimated to be in the probable maximum floodplain in developed areas during a summer day. The potential hazard to them would be reduced by the warning system, evacuation plan, and emergency preparedness efforts.

Conclusion: A flood of the 100-year magnitude would not pose a significant hazard to people, but over 4,000 people are in probable maximum floodplains. The degree of hazard would depend on how well the warning systems and evacuation plans worked. During such a large flood event it is likely that injuries or fatalities would result even if the nonstructural mitigation package operated properly. There would be a 14 percent reduction during the day and a 21 percent reduction at night of people in the probable maximum floodplain compared to existing conditions.

## IMPACT ON PROPERTY IN FLOODPLAINS

Many areas in the recreation area are subject to flash flooding. Flooding is most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor facilities are out of the floodplain. At Boulder Beach, all development is on a broad alluvial fan, with protection provided by earth dikes. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain. A more thorough discussion of floodplains can be found in the "Affected Environment" section of this document. The development concept plan graphics for each developed area show the extent of the 100-year and probable maximum floods.

Table 25 shows existing and proposed development in the floodplain for the proposed action and each alternative. The proposed action would mitigate the impact of floodwater to the 100-year level with structures, mitigate the effects of floods larger than the 100-year flood with warning systems and evacuation plans, and rely on relocation for some areas. Warning systems and evacuation plans would not provide any protection for property in the floodplains. Consequently, some property in the flood hazard zone would remain susceptible to flood damage and could be damaged or destroyed in the event of a flood. The cost of replacing structures left unprotected in the 100-year floodplain would be approximately $327,980; for replacing those in the probable maximum

floodplain approximately $20 million. These costs do not include utilities, furnishings, equipment, vehicles, flood control devices, debris removal, search and rescue, or expenses of victims. The cost to replace facilities damaged by the 100-year flood would be approximately 5 percent of the cost of replacing structures in the 100-year floodplain under existing conditions.

Table 25: Existing and proposed development in the floodplain that is left unprotected by structural flood mitigation measures and is vulnerable to flood damage or destruction.

| Structure | No-Action Alternative 100-year | No-Action Alternative PMF | Alternative A 100-year | Alternative A PMF | Alternative B 100-year | Alternative B PMF | Alternative C 100-year | Alternative C PMF |
|---|---|---|---|---|---|---|---|---|
| Katherine | | | | | | | | |
| Access<br>N&S Telephone Cove primitive use area & access | 1.9-mi gravel | | | | | | | |
| Circulation roads to NPS housing | 1,950-ft gravel | | | | 1,950-ft gravel | | | |
| Parking<br>east of motel | | 700-car gravel | | | | | | 700-car paved |
| west of motel | | 500-car paved | | | | | | 500-car paved |
| Launch ramp/ ready lane | | 8 lanes/150 x 200' paved | | | | | | 8 lanes/200 x 200' paved |
| NPS maintenance | | 2 800-sf bldgs<br>1.5-ac unpaved storage<br>800' fence | | | | | | |
| NPS & concession housing | | 1 permanent single-family | | | | | | 1 permanent single-family |
| Trailer village | | 33 short-term sites | | | | | | 33 short-term sites |
| Motel | | 52 units | | | | | | 104 units*<br>add pool* |
| Dry boat storage | 210 spaces | | 420 spaces | 210 spaces | | | 420 spaces | |
| Ice house | | small building | | | | | | small building |
| Comfort station | small building | | | | | | | small building |
| Cottonwood** | | | | | | | | |
| Access roads | | 5-mi paved | | | | 5-mi paved | | 5-mi paved |
| Circulation | | 2.6-mi paved | | | | 2.6-mi paved | | 2.6-mi paved |
| Parking | 290 paved<br>148 gravel | 200 paved<br>90 gravel | | | 290 paved<br>148 gravel | 200 paved<br>90 paved | | 490 paved*<br>238 gravel* |
| Ranger station | 1,800-sf building | | | | | | | 1800 sf building comfort station |
| NPS maintenance | 3,000-sf building, pave 25,000 sf, add 600' fence | | | | | | | |
| NPS housing | Three 1200-sf houses; seven 800-sf trailers<br>1,070-ft paved road | | | | | | | |

| Structure | No-Action Alternative 100-year | No-Action Alternative PMF | Alternative A 100-year | Alternative A PMF | Alternative B 100-year | Alternative B PMF | Alternative C 100-year | Alternative C PMF |
|---|---|---|---|---|---|---|---|---|
| Picnic area | 4 tables<br>1 large ramada | | | | 4 tables<br>1 large ramada | | | |
| Campground #4 & 17 DCP map | | 149 sites | | | | | | 149 sites |
| Trailer village | | 206 long-term sites; 75 short-term sites | | | | | | 206 long-term<br>75 short-term |
| Motel | | 24 units | | | | | | 48 units* |
| Restaurant | | 35 seats | | | | | | 70 seats* |
| Store | | 1,200 sf | | | | | | 2400 sf* |
| Dry boat storage | 350 spaces | | | | | | | 470 spaces* |
| Concession maintenance | 4,400-sf building<br>35,600-sf paved storage | | | | | | | 6,900-sf building*<br>35,600-sf paved storage |
| Concession housing | | 6 trailers<br>300' gravel road | | | | | | |
| Gas station | | 2 pumps | | | | | | 2 pumps |
| Comfort station | | small building | | | | | | small building |
| Fish-cleaning station | small building | | | | | | | small building |
| Willow Beach | | | | | | | | |
| Access roads<br>main access | 2-mi, 2-lane paved | | 2-mi, 2-lane paved | | 2-mi, 2-lane paved | | | 2-mi, 2-lane paved |
| trailer village access | 1/2-mi gravel | | 1/2-mi gravel | | | | 1/2-mi gravel | |
| Parking | 164 space paved | | | | 164 spaces paved | | | |
| Launch ramp | 8 lanes | | | | 8 lanes | | 8 lanes | |
| Ranger station | 1,000 sf | | | | | | 1,000 sf (storage only) | |
| NPS maintenance | 1,500-sf building<br>7,200-sf paved area<br>250' fence | | | | | | | |
| NPS housing (closed) | four 1,200-sf houses | | | | | | | |
| Trailer village | 57 long-term<br>18 short-term | | | | | | | |
| Motel | 24 units | | | | | | | |
| Restaurant | 100 seats<br>4,900 sf | | | | | | | |

| Structure | No-Action Alternative 100-year | PMF | Alternative A 100-year | PMF | Alternative B 100-year | PMF | Alternative C 100-year | PMF |
|---|---|---|---|---|---|---|---|---|
| Store | part of restaurant | | | | | | | |
| Dry boat storage | 120 spaces | | 120 spaces | | 120 spaces | | 120 spaces | |
| Concession housing trailer village | ten 1,200-sf trailers | | | | | | | |
| Water well buildings | three 10'x10' buildings | | | | | | | |
| Canoe/raft takeout | graded area | | graded area | | graded area | | graded area | |
| Trailer dump station/ gas station/storage | | | | | | | 1 pump | |
| Sewage lagoons | | one 1-ac<br>one 0.5-ac | | one 1-ac<br>one 0.5-ac | | | | one 1-ac<br>one 0.5-ac |
| Boulder Beach | | | | | | | | |
| Campground | | 338 sites | | | | | | 338 sites (10 group, two 500-sf comfort stations) |
| Trailer village | | 293 sites | | | | | | 368 sites* |
| Motel | | 44 units | | | | | | 88 units* |
| Store | | 5,500 sf | | | | | | 8,250 sf* |
| Las Vegas Wash | | | | | | | | |
| Launch ramp | | 5 lanes | | 5 lanes | | 5 lanes | | 5 lanes |
| Overton Beach | | | | | | | | |
| Swim beach | 1 ac | | 1 ac | | 1 ac | | 1 ac | |
| Campground | | 100 primitive sites | | | | | | |
| Temple Bar*** | | | | | | | | |
| Parking | | 95 spaces paved | | | | 95 spaces paved | | 365 spaces paved* |
| Launch ramp | | 4 lanes | | | | 4 lanes | | 8 lanes* |
| Ranger station | | | | | | | | 1,000-sf bldg* |
| NPS maintenance | | 2,000-sf bldg<br>22,000-sf paved area<br>850' fence | | | | | | 2,000-sf bldg<br>22,000-sf paved area<br>850' fence |
| NPS housing | 1,500-sf, single family | | | | | | | 1,500-sf, single-family |

Although data are available and cross sections have been developed for Boulder Beach, no maps of 100-year and probable maximum floodplains are available. The following structures are in low, flat areas; therefore, all development is shown in the PMF. Boulder Beach is on a broad alluvial fan and the flood hazard is from shallow sheet flows or unpredictable localized concentrations. This hazard is low compared to all other areas with flood hazard.

| Structure | No-Action Alternative 100-year | PMF | Alternative A 100-year | PMF | Alternative B 100-year | PMF | Alternative C 100-year | PMF |
|---|---|---|---|---|---|---|---|---|
| Campground | | 153 sites | | | | | | 153 sites |
| Trailer village | | 122 sites | | | | | | 122 sites |
| Motel | | 22 units | | | | | | 90 units*<br>1,200-sf pool* |
| Restaurant | | 76 seats | | | | | | 228 seats* |
| Store | | 1,500 sf | | | | | | 3,500 sf* |
| Concession housing | | 14 trailers | | | | | | 14 trailers |
| Gas station | | 2 pumps | | | | | | 2 pumps |
| Ice house | | small building | | | | | | small building |
| Comfort station | | 400 sf | | | | | | 400 sf |

Note: Structures listed in the 100-year floodplain are also in the probable maximum floodplain; however, to avoid repetition, only structures that are in the PMF but not the 100-year floodplain are listed in the PMF column.

* Indicates development that is within the probable maximum floodplain and is being expanded. These new or expanded facilities would be vulnerable to floods larger than the 100-year up to the PMF.

** For existing conditions (no-action alternative), the 100-year floodplain was mapped based on the assumption that existing earth dikes and channels would withstand such a flood. However, USDI Open File report 80-1216 "Potential flood and debris hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada," prepared in cooperation with the National Park Service, indicates that the dike above the employee housing area would be breached or overtopped by the 100-year flood, and the housing could be in a hazardous location depending on the location of the dike overtopping or breeching. Larger floods might endanger the campground and mobile home area. The 850-foot section of the dike that parallels the trailer village on the north might only control the 50-year flood. Breeching or overtopping of this section of the dike would allow flood waters to enter the trailer village and perhaps the store, restaurant, motel, associated parking area, gas station, and comfort station.

***For existing conditions (no-action alternative) the 100-year floodplain was mapped based on the assumption that existing earth dikes and channels would withstand such a flood. However, those existing structures are not likely to withstand a 100-year flood, and most of the facilities listed in the PMF would be susceptible to flood damage from a 100-year flood.

Table 26: Replacement costs of existing and proposed development in the floodplain that is left unprotected by structural flood mitigation measures and is vulnerable to flood damage or destruction

| | No-Action Alternative | | Alternative A | | Alternative B | | Proposed Action | |
|---|---|---|---|---|---|---|---|---|
| | 100-Year | PMF | 100-Year | PMF | 100-Year | PMF | 100-Year | PMF |
| Katherine | $ 533,863 | $ 3,148,423 | $ 50,000 | | $ 25,000 | | $ 83,863 | $ 3,116,863 |
| Cottonwood | 2,049,963 | 9,535,326 | -0- | | 470,330 | $4,012,300 | -0- | 9,412,083 |
| Willow Beach | 3,990,600 | 4,095,600 | 965,833 | $1,070,833 | 1,129,033 | | 239,833 | 1,194,833 |
| Las Vegas Wash | -0- | 31,250 | -0- | 31,250 | -0- | 31,250 | -0- | 31,250 |
| Overton Beach | 4,285 | | 4,285 | | 4,285 | | 4,285 | |
| Temple Bar | -0- | 3,644,367 | -0- | -0- | -0- | 148,500 | -0- | 6,339,321 |
| Grand Total | $6,578,000 | $29,457,250 | $1,020,118 | $1,156,370 | $1,608,650 | $5,329,970 | $327,980 | $20,098,630 |

Conclusion: A flood of the 100-year magnitude would not pose a significant hazard to structures but one of the PMF size would. During a 100-year flood, damage to structures would probably be only 5 percent of what it would be under no action. A PMF would probably cause significant damage to structures because very little would be done under this alternative to protect structures. It is estimated that damage to structures under the proposed action from the PMF would be 98 percent of that expected under the no-action alternative.

## IMPACT ON RESERVOIR WATER QUALITY

Based on available water quality data and the protected uses of water within Lake Mead NRA, water quality in Lakes Mead and Mohave is generally in compliance with established water quality standards throughout the year. However, isolated instances do occur where bacteriological pollution threatens the use of water in the NRA for full body contact recreation. The pollution source is improper disposal of human waste in the shoreline zone around the lakes. Concentrations of visitors at swim beaches and popular coves increases the probability of pollution. The health risk results from water use like swimming, water skiing, and other similar activities during which water may be ingested accidently, and certain sensitive body organs (e.g., eyes and nose) might be exposed to water.

The allowable maximum limits for fecal coliforms (measure of bacteriological pollution in units/100 ml) for full body contact recreation in the Arizona and Nevada water quality standards are 200 as a geometric mean (5-sample minimum); 400 in 10 percent of samples for a 30-day period; and 800 in a single sample.

Elevated counts of fecal coliforms generally occur during heavy use days (such as Labor Day), when lake levels are low, and at undeveloped coves accessible only by water where use is low to moderate and no sanitary facilities are available. In the latter case, localized incidents of high fecal coliforms occur when water levels rise and such areas are inundated. It should be pointed out that bacteriological pollution is rare in open areas (such as Boulder Beach) where wind and wave action provide adequate mixing; however, in areas where beaches are located in harbors or confined areas, incidents of elevated coliform counts are common by late summer. For example, fecal coliform levels have reached 1,200 at Cottonwood Cove, 1,100 at Temple Bar, and up to 24,000 in Las Vegas Bay (pollution from Las Vegas is discharged from Las Vegas Wash into Lake Mead).

Water quality at designated swimming beaches in Lake Mead NRA is regularly monitored in accordance with applicable state and local health codes to identify unsafe water quality conditions. When unsafe conditions are noted, that particular area is more closely monitored and may be closed to public use. The Las Vegas Wash harbor has been closed since 1976, and several heavily used shoreline areas like Boulder Beach and the Katherine swim beach have had conditions on several occasions that nearly dictated their closure.

The proposed action contains several actions that would change shoreline visitation patterns. These changes could alter existing water quality conditions and affect the public health hazard. Swim beaches would be relocated at Katherine and Cottonwood and would be provided at Temple Bar and Echo Bay. Many of the DCP proposals are designed to resolve existing crowding and congestion problems or otherwise improve the visitor experience. These actions could indirectly lead to greater increases in visitation than projected and could thus affect water quality and the related public health.

Under the proposed action the existing conditions described above would likely get worse, because of the increasing visitation that is anticipated. Over the life of the plan, visitation could be expected to increase to about 1.38 times existing levels. Increased visitation along the shoreline would create pollution of shoreline water; however, the mathematical relationship of this correlation cannot be determined with existing data. Nevertheless, temporary swim beach closures or closures of popular coves might become necessary because levels of bacteriological pollution might exceed state standards.

Up to now there have not been any recorded cases of serious infectious diseases being contracted because of contact with Lake Mead's water. Under the proposed action there would be an increased risk of diseases from contaminated water, but the degree of risk cannot be determined. The water quality monitoring program would continue to assess this risk and determine when remedial actions are necessary. This monitoring program is described under shoreline pollution in the "Lake Use Management" section of the proposed action.

The existing situation at Katherine and Cottonwood would be improved to an unknown degree because the swim beach would be relocated. The water quality would be improved and the resulting health hazard reduced, because the new swim beach locations would be more exposed to the main body of lake water and increased wave action. That situation results in greater mixing of the water with accompanying dilution of pollution. Thus, even with increased use, the new swim beaches would be less likely to pose public health hazards.

The new swim beaches at Temple Bar and Cottonwood Cove would concentrate visitors at these shoreline locations. However, both locations are exposed to the main body of the lake and, as described previously, would not tend to pose public health hazards. To ensure that the public health risk is insignificant, both areas would be included in the water quality monitoring program.

Conclusion: Although visitation is expected to increase, the proposed action would not pose significant public health hazards from water pollution in the recreation area; the hazard would be reduced by an unknown amount at the Katherine and Cottonwood swim beaches compared to existing conditions.

## IMPACT ON DESERT SPRING ECOLOGICAL COMMUNITIES

Rogers and Bluepoint springs are unique warm water springs. They contain native and exotic fish, provide habitat for waterfowl and shorebirds during their migrations, contain aquatic and emergent vegetation, and provide a rare moist habitat and water source for small mammals, reptiles, amphibians, and nesting birds. While such desert spring ecological communities are rare and important habitats, they are not as critical as they once were because the reservoirs provide some comparable shoreline habitat. Spring communities amount to less than 100 acres or less than .01 percent of the recreation area. Rogers and Bluepoint springs amount to less than 10 acres. Paths have formed around both springs from visitor use.

The proposed action at Rogers Spring calls for expansion and paving of an existing gravel parking area, addition of five picnic tables, addition of a small composting toilet, and rehabilitation of an existing interpretive wayside. At Bluepoint Spring one covered picnic shelter with three picnic tables would be added. Desert spring ecological communities would not be affected by mineral leasing because none of them would be in areas subject to leasing.

The proposed developments at these two springs would not directly affect any of the spring community habitat. All development would be in desert shrub or previously disturbed and developed areas. The only impacts to the spring communities would result from increased use by visitors. If visitation to these springs increased 38 percent, as projected for the recreation area over the life of the plan, footpath use around the springs would be expected to increase by at least that much. Emergent vegetation and other moist terrestrial vegetation would be destroyed, and the spring water could be polluted by improperly disposed trash and human waste. The degree of these impacts cannot be determined. The spring communities would be monitored by the recreation area's resource management staff, and if increases in impacts from visitor use were noted, corrective measures would be taken, including boardwalks or fences to constrain visitor movement and information to educate visitors about these sensitive habitats. Such mitigating measures have been very successful with sensitive habitats elsewhere in the national park system.

Conclusion: The proposed action would not directly affect Rogers or Bluepoint springs, but indirect impacts from increasing visitor use could result in trampled vegetation or polluted waters.

## IMPACT ON SOILS

Soils in the recreation area are extremely variable. Climate, vegetation, parent material, elevation, slope, and aspect affect the development of these soils, which are characterized by a wide range of physical and chemical properties. Texture, permeability, depth, stoniness, organic content, alkalinity, and other properties are highly diverse and change quickly within short distances.

Offroad vehicles rut soils with their tires, pulverize and disperse surface soil and compact the subsurface soil, demolish chemically bonded surface crusts and protective layers of desert pavement, and crush and destroy plants including fungus, algae, and lichens that bind the soil together. Once the desert lithosols in the recreation area have been broken by off-road vehicles crossing them, they are exceptionally vulnerable to wind, water, and mechanical erosion.

Visitors are permitted to drive land vehicles only on approved roadways in the recreation area under existing regulations. However, law enforcement, information services, and physical barriers have not been successful in curbing the illegal activity of driving off these designated roads. Staffing is inadequate to provide the necessary personnel for air, water, and land detection patrols and to apprehend violators of the offroad vehicle regulations. They often escape punishment by claiming there was no way for them to have known of the regulations.

Under the proposed action more adequate maps and information services would be provided; regulatory signs would be posted at all entrances to the recreation area, including backcountry offroad access points that do not connect to the approved road system. In the Northshore Area where the most damage has occurred, existing gravel roads would be improved and new spur roads would be added to provide better access roads to the reservoirs. Improved information services would include offsite talks to offroad vehicle organizations, identification of federal lands where offroad vehicle use is not restricted, and distribution of appropriate information through offroad vehicle distributors in the region. This latter action might be done in cooperation with other federal land management agencies in Utah, Arizona, Nevada, and California. Under the proposed action, the land between the Northshore Road and the Northshore Loop Road would be zoned as a scientific research area to study the effectiveness of various rehabilitation methods. These methods would probably include sweeping out ruts, scattering gravel to replace displaced desert pavement, and seeding with native plants to reestablish a diverse and self-reproducing vegetative cover. Offroad driving for management or enforcement purposes and for access permits would be restricted.

Once offroad vehicle use was eliminated, the soils and plant cover would restore themselves at an extremely slow rate; invading weed species would generally replace native species, greatly simplifying a once complex soil-building plant and animal community.

A motorcycle driven so as to have the smallest impact on the desert soils would affect 1 acre of land for ever 20 miles it traveled. A four-wheel-drive vehicle driven in a similar manner would affect 1 acre of land for every 6 miles it traveled. About 350 acres of the recreation area have been damaged severely enough to need some form of rehabilitation, and an additional 30 to 40 acres are being scarred each year. A description of these soils is shown on the Resource Damage map.

The information services, maps, and signing described under the proposed action would ensure that cooperative visitors with offroad vehicles would not inadvertently damage soils in the recreation area. Similarly, visitors reaching the reservoirs on approved roads would be

less tempted to break new ground for a more private setting if approved roads already extended along the lakeshore. The Northshore Loop Road would reduce offroad use by providing access to highly desired areas along the lake and by providing a route for detection and enforcement personnel. The soil damage created by offroad vehicle drivers who are less inclined to be cooperative would not be curbed by the proposed action because it does not call for additional enforcement personnel and equipment to maintain a strong detection and enforcement function. Thus, the proposed action would reduce the rate at which soils are being destroyed, but it would not be expected to bring it to a halt.

The rehabilitation research efforts of the proposed action would eliminate visual scars and greatly reduce the rate of wind, rill, and gully erosion on about 100 acres of the recreation area and restore a semblance of desert pavement and native plant cover. Rehabilitation, however, cannot really reclaim severely damaged areas in the sense of restoring the original ecosystem that took millenia to form. Successful methods of restoration arising from research would be applied to all areas in the recreation area that have been damaged by offroad vehicle use and by any other activities that similarly mark the land.

Facilities in developed areas have destroyed or severely damaged the natural soils on about 800 of the recreation area's 1.5 million acres (about .0005 percent of the area). The proposed roadways and visitor facilities would add about 503 acres to the total area of lands devoted to these purposes. Although rehabilitation and landscaping would mute the scars from construction and prevent the loss of soil through erosion, the natural productivity of these soils would be lost.

The construction of facilities under the proposed action would compact adjacent soils and create impermeable surfaces which would increase local runoff and erosion in the short expanse between the activity or structure and the lake. Because most facilities are immediately adjacent to major natural washes that feed immediately into the reservoirs, this erosion would be minor and very limited in area. Roadway construction, however, blocks and channelizes runoff as well as increases it. Slopes downhill from the roadway are deprived of overland flow, and downhill gullies and washes are depleted or augmented by the location of road culverts. Upslope gullies and slopes would flood and pond if the water was not sent under the roadway by culverts, increasing sediment deposition. The patchy soil moisture regime thus created would express itself in stands of vegetation that were more or less robust than average. The more robust communities would probably balance the less robust in the amount of sediment eroded by rainsplash and carried in overland flow.

The proposed roadways would require approximately 1,450,000 cubic yards of material to be removed in cuts. The only major cuts would be along a 3-mile section of the lakeshore road where cuts of 30 to 40 feet would have to be made. Such cuts often reveal geologic features in the bedrock that are otherwise masked by soils and overburden. With adjacent pulloff areas, some of these cuts can serve both educational and interpretive purposes. Roadways and flood prevention fill at developed areas would require approximately 1,700,000 cubic yards of material--about 250,000

cubic yards more than that removed in cuts. Some suitable material could be obtained where excavation deepened washes at their mouths in the developed areas as protection against flash flooding. For the most part, however, the additional fill would be brought into the recreation area from established borrow pits or rock waste sites.

The intent of the proposed action is to restrict mineral leasing to the resource utilization subzone, as shown on the Proposed Action/Management Zoning map, which is consistent with NPS management zoning policies as defined in NPS-2 "Planning Process Guideline". Where current leases exist on lands outside the resource utilization subzone, the National Park Service would not renew any leases once the full term of the lease expired, unless that lease was held by production. Where other outstanding mineral rights exist in areas other than the resource utilization subzone (i.e., mining claims or private mineral rights), the National Park Service would manage the surface according to the surrounding land classification, and development of those mineral rights would continue to be evaluated to determine appropriate protection options. About 148,970 acres would be available for mineral leasing consideration, while leasing would be gradually phased out on the remainder of the recreation area. Following finalization of the GMP, the excepted areas regulations for Lake Mead (43 CFR 3100 and 3500) would be revised to reflect these changes.

Under the proposed action, up to 30,000 acres could be subjected to mineral development on 18,487 acres of existing leases and 11,640 acres of pending permits (if approved). The most likely mineral activity would be exploration for hard-rock minerals on 2,500 acres of existing mineral leases and 11,640 acres of pending prospecting permits. Exploration activities normally involve collection of rock samples, magnetic surveys, geochemical analysis, and core drilling. Each drill site requires about ¼ acre, and five to 25 holes may be drilled to locate and determine characteristics of an ore body. Acreage necessary for development of an ore deposit would depend on location and size of the deposit and mining method. Seismic exploration on the 16,000 acres of existing oil and gas leases could also potentially occur under the proposed action. Acreage disturbed by these activities would depend on whether existing roads were available in the lease block, but in most cases impacts would be minimal. Over half the acreage under application would be in Gregg Basin/Virgin Valley zones of the NRA; the remaining applications would fall in the Willow Beach and Cottonwood zones. Most of the 21,000 acres under application that fall in zones not open to mineral leasing are in the Shivwits Plateau zone.

Exploration activities associated with prospecting permits and oil and gas leases could result in damage to soils through excavation and erosion, with additional losses expected from associated excavation and removal for road construction and similar earthwork. Soil nutrients that have developed over long periods would be reduced in these disturbed soils by erosion and accelerated weathering, and compaction and abnormally high soil temperatures could also occur. The reclamation potential of the disturbed areas would be reduced unless proper care was taken to mitigate soil loss. Because of the diversity of soils in the recreation area, site-specific soils data would be acquired, and detailed impact assessment and reclamation planning completed before mining approval.

Mineral leasing would not be expected to significantly affect soils in any area of the park under the proposal. Some damage or loss could be expected from sporadic exploration activities; however, the amount of acreage affected would likely be less than 300 acres over the next 10 years if the present mineral development trends continued in the area.

Conclusion: Under the proposed action the rate of damage and erosion from offroad vehicles would be moderately diminished, and about 350 acres of damaged soils would be rehabilitated. Developments would destroy or severely damage about 500 acres of lithosols and red desert soils and cause minor disruptions in drainage patterns, which would temporarily increase erosion potential. Loss or damage to recreation area soils resulting from mineral leasing activities would not be significant over the next decade, assuming mineral development activity followed historical trends.

## IMPACT ON SIGNIFICANT NATURAL FEATURES

Significant natural features include unique geological areas, outstanding scenic vistas, outstanding coves, and areas in the environmental protection subzone or outstanding natural feature subzone. Under the proposed action, none of these areas would be available for mineral leasing, so no impacts from pending permits would be expected.

## IMPACTS ON THREATENED OR ENDANGERED SPECIES

The endangered bonytail chub, Gila elegans, and the threatened bald eagle, Haliaeetus leucocephalus, are the only two federally listed animal species that are known to occur. There are no threatened or endangered plant species, proposed species, or critical habitats in the NRA. There are several federal candidate species that do, or could, inhabit or visit the recreation area. Some of these species are also listed by the states of Arizona and Nevada as threatened or endangered species, or species of concern. Table 18 identifies the status and legal classification of all threatened, endangered, or other rare species. Of the 20 species, 18 are known in the recreation area. Of the 18, six are rare migratory transients with wide distributions outside the area. Thus, only 12 are of primary concern.

The intent of the proposed action is to restrict mineral leasing to the resource utilization subzone as shown on the Proposed Action/Management Zoning map, which is consistent with NPS management zoning policies as defined in NPS-2, "Planning Process Guideline." Where current leases exist on lands outside the resource utilization subzone, the National Park Service would not renew any leases once the full term of the lease expired, unless that lease was held by production. Where other outstanding mineral rights exist in areas other than the resource utilization subzone (i.e., mining claims or private mineral rights), the National Park Service would manage the surface according to the surrounding land classification, and development of those mineral rights would continue to be evaluated to determine appropriate protection options. About 148,970 acres would be available for mineral leasing

consideration, while leasing would be gradually phased out on the remainder of the recreation area. Following finalization of the GMP, the excepted areas regulations for Lake Mead (43 CFR, 3100 and 3500) would be revised to reflect these changes.

Under the proposed action, up to 30,000 acres of the NRA could be subject to mineral development on 18,487 acres of existing leases and 11,650 acres of pending permits (if approved). The most likely mineral activity would be exploration for hardrock minerals on 2,500 acres of existing mineral leases and 11,640 acres of pending prospecting permits. Exploration activities normally involve collection of rock samples, magnetic surveys, geochemical analysis, and core drilling. Each drill site requires about ¼ acre, and five to 25 holes may be drilled to locate and determine characteristics of an ore body. Acreage necessary for development of an ore deposit would depend on location and size of the deposit and mining method. Seismic exploration on the 16,000 acres of existing oil and gas leases could also potentially occur under the proposed action. Acreage disturbed by these activities would depend on whether existing roads were available in the lease block, but in most cases impacts would be minimal. Over half the acreage under application would be in Gregg Basin/Virgin Valley zones of the NRA; the remaining applications would fall in the Willow Beach and Cottonwood zones. Almost all of the 21,000 acres under application that fall in zones not open to mineral leasing are in the Shivwits Plateau zone.

The proposed action would place 1,050,030 acres or 70 percent of the NRA, in the natural zone. Known habitat or potential habitat for rare, threatened, or endangered plant and animal species would be further protected by placement in the environmental protection or outstanding natural feature subzone of the natural zone. Areas open to mineral leasing would be the 148,970 acres in the resource utilization subzone and the existing leases and pending prospecting permits described below.

About 30,000 acres have the highest potential for mineral development--18,487 acres of existing leases and 11,640 acres of pending prospecting permits (if approved). None of these leases and pending permits are in areas where they could potentially affect any threatened or endangered animal species. Two existing leases and one pending prospecting permit are located within 5 miles of known locations of candidate threatened or endangered plant species. Additional surveys on these leases or permits could reveal additional populations of these plants. Potential threats to these plants include physical destruction of populations or habitat and illegal collection. When specific mineral development proposals were received in these areas, surveys would be conducted and protective stipulations applied to the plan of operation. However, it is not certain that all threats would be avoided.

Proposed developments that could affect rare, threatened, or endangered plant and animal species include the Fire Mountain developed area and access points in the Cottonwood East vicinity and at Detrital Bay. None of the developments would be in areas identified as habitat, but they would all be close to identified habitat areas. Visitor movement around these areas could cause conflicts. Any effects on threatened or endangered species would be due to the increased visitation in habitat areas near these new developments.

Areas used by the threatened bald eagle are high cliffs, well above the water. These areas are remote and are lightly used only during the winter; they are not used for nesting. Although use would likely increase because of the new Fire Mountain developed area and Detrital Bay access point, it would remain very low during winter months and would not likely affect the eagles.

Visitation is now very light in the Cottonwood East vicinity, where the proposed access point could affect the endangered bonytail chub recovery cove. The endangered species recovery team for the bonytail chub would be consulted before locating the access point, to minimize impacts on the chub.

The effects of new developments on threatened or endangered species would be further mitigated during the period before construction (about 10 years). Both species would be closely monitored as visitation increased. Management recommendations based on this monitoring would be designed to allow the areas to be developed with minimal effects on these species.

Conclusion: Slight impacts on threatened or endangered species resulting from the proposed action could occur but are now judged to likely be insignificant.

## IMPACT ON VEGETATION

Approximately 71 percent of the NRA is dominated by the creosotebush community. This community type is widespread throughout the desert southwest and is the representative low elevation vegetation type in the Mohave and Sonoran deserts. Vegetation typical of higher elevations includes blackbrush, sagebrush, and pinyon/juniper. These vegetation types are common throughout the intermountain region.

Precipitation rates in low elevation communities are generally less than 5 inches annually, while higher elevations receive 5 to 15 inches. Because of these low precipitation rates, revegetation rates on disturbed sites may be as much as 50 to 75 years.

The intent of the proposed action is to restrict mineral leasing to the resource utilization subzone, as shown on the Proposed Action/Management Zoning map. Where current leases exist on lands outside the resource utilization subzone, the Park Service would not renew any leases once the full term of the lease expired, unless that lease was held by production. Where other outstanding mineral rights exist in areas other than the resource utilization subzone (i.e., mining claims or private mineral rights), the Park Service would manage the surface according to the surrounding land classification, and development of those minerals would continue to be evaluated to determine appropriate protection options. About 148,970 acres would be available for mineral leasing consideration, while leasing would be gradually phased out on the remainder of the recreation area. Following finalization of the GMP, the excepted areas regulations (43 CFR, 3100 and 3500) would be revised to reflect these changes.

Under the proposed action up to 30,000 acres could be subject to mineral development on 18,487 acres of existing leases and 11,640 acres of pending permits (if approved). The most likely mineral activity would be exploration for hard-rock minerals on 2,500 acres of existing mineral leases and 11,640 acres of pending prospecting permits. Exploration activities normally involve collection of rock samples, magnetic surveys, geochemical analysis, and core drilling. Each drill site requires about ¼ acre, and five to 25 holes might be drilled to locate and determine characteristics of an ore body. Acreage necessary for development of an ore deposit would depend on location and size of the deposit and mining method. Seismic exploration on the 16,000 acres of existing oil and gas leases could also potentially occur under the proposed action. Acreage disturbed by these activities would depend on whether existing roads were available in the lease block, but in most cases impacts would be minimal. Over half the acreage under application would be in the Gregg Basin/Virgin Valley zones of the NRA; the remaining applications would fall in the Willow Beach and Cottonwood zones. Most of the 21,000 acres under application that fall in zones not open to mineral leasing are in the Shivwits Plateau zone.

Impacts to vegetation under the proposed action would be greatest if an ore deposit was discovered and production of a mine initiated. Several hundred acres of vegetation could potentially be destroyed through development of mine surface facilities, access roads, and tailings piles. However, given the history of Lake Mead leasing, this level of development is unlikely. Exploration activities on mineral and oil and gas leases would disturb only a small amount of native vegetation.

Conclusion: Only minor impacts to vegetation under this alternative would likely occur.

## IMPACT ON DESERT BIGHORN SHEEP

Under the proposed action, no desert bighorn habitat would be available for mineral leasing; therefore, no impacts from pending permits would be expected. However, existing oil and gas leases in the Pinto Valley, totaling 10,886 acres, are in an area of bighorn sheep habitat. If current owners of these leases pursued exploration activities in this area, impacts to desert bighorn could be expected. Seismic exploration could cause more stress on the herd due to increased human presence and noise from blasting and vehicle travel. Continued stress in bighhorn populations elsewhere has led to population die-offs because of increased susceptibility to disease organisms. Careful alignment of seismic lines, placement of remote recorders by hiking into sites, and timing of operations would reduce this threat.

To mitigate impacts to bighorn sheep populations if mineral leases have active mineral operations taking place on them, a quarterly population and distribution survey would be conducted on those leases and the adjacent lands inhabited by the bighorn. A program to collect and record data needed for this type of survey is being developed by the Cooperative National Park Resources Studies Unit, University of Nevada, Las Vegas. This program will gather baseline population data and annual herd

movements for all sheep populations near mineral leases, so that any changes from the normal patterns can be easily identified.

All operations that would occur within known lambing areas would contain a stipulation preventing operations from taking place during the lambing period (normally late in December to early April). If significant detrimental impacts to a bighorn population from exploration or mining operations were found, a temporary shutdown of operation would be made until corrective actions could be made to prevent further detriment to the herd.

Conclusion: If exploration activities remained sporadic, as in the past, impacts to the sheep population and their overall population health should be minor.

## IMPACT ON VISITOR CROWDING/CONGESTION

Existing conditions at the developed areas are extremely crowded and congested on weekends during the summer. Holiday weekends are the worst. Memorial Day weekend has had visitation of 254,000. Annual visitation is around 6.5 million and expected to increase to around 9 million by the year 2000. Currently it is not unusual for visitors at several of the larger developed areas to wait up to an hour to launch their boats and twice that long on a holiday weekend. Several of the popular campgrounds and motels are full during the summer. At several developed areas, confusing circulation systems frustrate first-time visitors who are trying to find their way around. Illegal parking along road shoulders is a common problem that results when existing parking areas become full.

The proposed action would accommodate increasing visitor use and solve existing crowding/congestion problems by expanding and improving existing developed areas, improving existing access points to the lakeshores, and providing new developed areas. (For a full discussion of these actions, refer to the "Alternative Development Concept Actions" section.) These actions would include many proposals intended to accommodate increasing visitation or to solve crowding/congestion. To understand the magnitude of these proposals, the increases in parking, overnight accommodations, and launch ramps are used as examples. The proposed action would include an increase of 7,470 parking spaces (19,660 spaces exist), or a 38 percent increase. There are 1,755 overnight accommodation units (a unit is either one campsite, one motel room, or one RV site). The proposed action would increase the number of units by 1,180 or an increase of 67 percent. There would be 73 launch ramp lanes, and the proposed action would add 22, an increase of 30 percent.

Over the life of the plan visitation is expected to increase by about 68 percent, and most visitor facility proposals call for increases from 35 to 85 percent above existing levels. This parity between expected use and capacity of proposed facilities indicates that crowding/congestion would not get any worse than it is now. However, it should be less than current levels because of other proposals that cannot be quantified. For example, circulation improvements would facilitate vehicle and pedestrian movements in several developed areas.

Conclusion: The proposed facility improvements and expansions would reduce current crowding/congestion by an unknown amount compared to existing levels, while accommodating increasing numbers of visitors.

## IMPACT ON VACATION CABIN SITE RESIDENTS

Lake Mead has three lakefront areas in which sites may be leased for privately owned vacation cabins. These areas are Katherine Landing, which has 39 cabin sites, Stewarts Point, which has 60 cabin sites, and Temple Bar, which has 36 cabin sites. Cabin site occupancy is for personal, not commercial, use. Department of the Interior regulations (43 CFR 21) prohibit granting new leases for cabin site occupancy within Lake Mead. Under the propsed action, cabin site occupancy would continue at the three developed areas. Extensions of leases up to five years would continue to be granted until the need for public use of the cabin site areas dictated termination. The determination of public need would be made two years in advance of the common expiration date.

Conclusion: The proposed action would have no effect on cabin site residents.

## IMPACT ON TRAILER VILLAGE RESIDENTS

NPS trailer village policy allows for short- (30-day occupancy or less) and long-term sites, and currently most of the developed areas around the lakes have concessioner-operated trailer villages for long- and short-term visitors. Under the proposed action, to meet an existing demand for RV sites, some concessioner trailer villages might be expanded or converted to provide for more short-term sites. The number of long-term, short-term, and RV sites that are available at each area and the changes under the proposed action are presented below

| Area | Existing Number of Sites Long/Short/RV | Proposed Action |
|---|---|---|
| Katherine Landing | 104/39/0 | Add 40 RV sites |
| Cottonwood Cove | 223/75/0 | Retain existing |
| Fire Mountain | 0/0/0 | Add 50 RV sites |
| Willow Beach | 60/18/0 | Relocate 50 long-/18 short-term sites<br>Add 50 RV sites |
| Boulder Beach | 215/75/0 | Add 75 short-term sites |
| Las Vegas Wash | 0/ 0/0 | Add 80 RV sites |
| Callville Bay | 94/6/0 | Add 29 RV sites |
| Boxcar Cove | 0/ 0/0 | Add 50 RV sites |
| Echo Bay | 69/58/0 | Add 42 RV sites |
| Overton Beach | 19/13/0 | Relocate/convert to 15 long-term, 30 RV sites |
| Temple Bar | 103/13/0 | Remove 10 long-and 7 short-term sites |
| Totals | 887/297/0 | |

The proposals to add RV sites at most of the developed areas would have no effect on existing trailer village residents. The effects of converting long-term sites to short-term sites would be mitigated by converting them as current residents vacated the sites. Trailer village residents would be most affected in the following areas: Willow Beach, where 50 of the 60 long-term and all 18 short-term residents would be relocated out of the flood-hazard zone to a safer area; Overton Beach, where 15 long-term and 13 short-term residents would be relocated, and 4 long-term sites would be removed; and Temple Bar, where 10 long-term and 7 short-term residents would be removed to provide for a high-water parking area.

The social impact resulting from these trailer village relocations would be felt most by the four long-term residents at Overton Beach and 10 long-term residents at Temple Bar. These people would have to relocate to other areas within the recreation area or to communities outside the area. This would be a traumatic event to many of these occupants, who have spent as many as 30 years in their trailers. Throughout the years, many have invested their time, energy, and creativity in landscaping and home improvements that they hoped to enjoy for the rest of their lives. There could be some economic impact to some of the occupants because the government is not required to relocate renters and lessees. The number of long-term sites adversely affected at these areas is 14 out of 887 for the entire NRA, or 2 percent of the total long-term sites. Only seven of the 297 short-term sites, or 2 percent, would be affected. These impacts would be mostly mitigated, because the number of long-term trailer residents would be reduced through attrition before any action would be taken to force residents from their trailer spaces.

Conclusion: The proposed action would have little or no effect on existing trailer village residents at most developed areas. Trailer village residents affected by the proposal would be those at Willow Beach, where long-term and short-term occupants would be relocated to a safer area, and those at Overton Beach and Temple Bar.

## IMPACT ON LEVEL OF CONCESSION SERVICES

The following table summarizes the level of services to be provided by the concessioner under the proposed action.

Conclusion: Comparing the proposed concession services to existing conditions, there would be an increase in the level of services in eight out of the nine categories. These increases would range from 34 percent in rental boats to 161 percent in the number of motel units. In one of the nine categories--long-term trailer villages--the number of spaces would decrease by 2 percent.

Table 27: Impact on Level of Concession Service, Proposed Action

| | Trailer Village Long-Term/ Short-term Sites | Motel Units | Restaurant Seats | Store Square Feet | Marina Slips/Moorings | Rental Boats Houseboats/ Other | Dry Boat Storage Spaces | Gas Station # Pumps | Gas Dock # Boat Capacity |
|---|---|---|---|---|---|---|---|---|---|
| Katherine Zone | | | | | | | | | |
| Katherine Landing | 104/79 | 104 | 234 | 7,200 | 805/0 | 75/41 | 420 | 2 | 14 |
| Lower Mohave East | 0 | 0 | 0 | 2,000 | 0 | 0 | 0 | 0 | 4 |
| Cottonwood Zone | | | | | | | | | |
| Cottonwood Cove | 223/75 | 48 | 70 | 2,400 | 535/0 | 25/31 | 465 | 2 | 8 |
| Fire Mountain | 0/50 | 25 | 50 | 3,000 | 200/0 | 0/0 | 120 | 0 | 0 |
| Willow Beach Zone | | | | | | | | | |
| Willow Beach | 60/68 | 48 | 100 | 1,000 | 270/16 | 0/40 | 120 | 1 | |
| Boulder Basin Zone | | | | | | | | | |
| Boulder Beach | 215/150 | 88 | 314 | 8,250 | 875/0 | 0/78 | 275 | 0 | |
| Las Vegas Wash | 0/80 | 0 | 54 | 3,300 | 630/3 | 0/70 | 200 | 0 | 4 |
| Callville Bay | 94/30 | 30 | 60 | 1,000 | 1,045/0 | 15/33 | 166 | 2 | |
| Boxcar Cove | 0/50 | 35 | 50 | 3,000 | 0/0 | 0 | 120 | 0 | |
| Echo Bay Zone | | | | | | | | | |
| Echo Bay | 69/100 | 104 | 120 | 11,000 | 530/0 | 90/25 | 200 | 4 | |
| Overton Beach Zone | | | | | | | | | |
| Overton Beach | 15/30 | 0 | 0 | 1,800 | 0/140 | 0/12 | 65 | 2 | 3 |
| Virgin/Temple Zone | | | | | | | | | |
| Temple Bar | 93/6 | 88 | 228 | 3,500 | 980/0 | 45/15 | 300 | 2 | |
| Totals: Proposed Action | 873/718 | 570 | 1,280 | 47,450 | 5,870/159 | 250/345 | 2,451 | 15 | 33 |
| Existing Conditions | 887/297 | 218 | 834 | 25,600 | 3,317/99 | 170/258 | 1,328 | 11 | 24 |
| Net change | -14/+421 | +352 | +446 | +21,850 | +2,553/+60 | +80/+87 | +1,123 | +4 | +9 |
| Percent change | -2/+42 | +1604 | +53 | +85 | +77/+61 | +47/+34 | +85 | +36 | +38 |

## IMPACT ON MINERAL LEASING OPPORTUNITY

The intent of the proposed action is to restrict mineral leasing to the resource utilization subzone, as shown on the Proposed Action/Management Zoning map, which is consistent with NPS management zoning policies as defined in NPS-2 "Planning Process Guideline." Where current leases exist on lands outside of the resource utilization subzone, the Park Service would not renew any leases once the full term of the lease expired, unless that lease was held by production. Where other outstanding mineral rights exist in areas other than the resource utilization subzone (i.e., mining claims or private mineral rights), the Park Service would manage the surface according to the surrounding land classification, and development of those mineral rights would continue to be evaluated to determine appropriate protection options. About 148,970 acres would be available for mineral leasing consideration, while leasing would gradually be phased on the remainder of the recreation area. Following finalization of the GMP, the excepted areas regulations for Lake Mead (43 CFR, 3100 and 3500) would be revised to reflect these changes.

Under the proposed action, up to 30,000 acres of the NRA could be subject to mineral development on 18,487 acres of existing leases and 11,640 acres of pending permits (if approved). The most likely mineral activity would be exploration for hard-rock minerals on 2,500 acres of existing mineral leases and 11,640 acres of pending prospecting permits. Exploration activities normally involve collection of rock samples, magnetic surveys, geochemical analysis, and core drilling. Each drill site requires about ¼ acre, and five to 25 holes may be drilled to locate and determine characteristics of an ore body. Acreage necessary for development of an ore deposit would depend on location and size of the deposit and mining method. Seismic exploration on the 16,000 acres of existing oil and gas leases could also potentially occur under the proposed action. Acreage disturbed by these activities would depend on whether existing roads were available in the lease block, but in most cases impacts would be minimal. Over half the acreage under application would be in Gregg Basin/Virgin Valley zones of the NRA; the remaining applications would fall in the Willow Beach and Cottonwood zones. Almost all of the 21,000 acres under application that fall in zones not open to mineral leasing are in the Shivwits Plateau zone.

The most immediate impact of removing the remaining 1,333,505 acres of the park from mineral leasing consideration would be on the 17,590 acres under pending application in the Shivwits Plateau zone where uranium exploration is proposed. Under this alternative these applications would be rejected. The areas having the highest potential for mineral resources within the Shivwits zone are in mineralized breccia pipes of which approximately 10 are known to exist in the area. Most breccia pipes are not mineralized, but substantial production of uranium, copper, and other metals has come from breccia pipes in the Arizona strip country, including Hacks Canyon and Pigeon mines northeast of the NRA. The proposed action would leave two of the known pipes open to development: the Copper Mountain pipe (currently under claim) and the "mule pipe" (currently under lease). The remaining eight pipes would be removed from further mineral leasing consideration. However, two of these eight

pipes might be located within Grand Canyon National Park and therefore not available for mineral leasing. Another pipe, the "Parashant pipe" was drilled by the Cotter Corporation in 1968, and although anomalous radioactivity was present, no commercial grade uranium was found (USDI 1977). The other five pipes contain only speculative resources. Reports by the U.S. Geological Survey of reserves and resources in the Parashant-Whitmore Canyon structures are highly speculative but estimate inferred reserves of 250 tons of $U_3O_8$ and hypothetical resources of as much as 3,000 tons of $U_3O_8$ (USDI 1977). The only known resources are currently in the Copper Mountain pipe, which would still be available for development.

Under the current price structure for uranium, it is unlikely that any of the uranium resources contained in the known breccia pipes would be developed. Because of the high cost of development and operation in this remote area and the large distances to existing uranium mills, a price of nearly $60/pound would be necessary before these pipes would be economical to mine (Energy Fuels, personal communication). With a present price of $17.50 per pound (Eng. and Mining Journal, vol. 185, no. 10, Oct. 1984), it is unlikely that pipes in the NRA would be economically feasible to mine for many years. Contributing to this outlook is the fact that demand for uranium would likely be bleak for the short term and near long term. This is a result of the following three factors:

The Three Mile Island nuclear accident in 1979 greatly reduced the number of expected nuclear reactor facilities planned for construction. Lack of public confidence in the nuclear program as a whole caused many utilities to cancel contracts to construct nuclear facilities. Delays in the licensing of present facilities due to concern over TMI has caused ripples in the financial community and utility companies. Nuclear power was dealt a severe public relations blow and will take years to recover its former status.

The present worldwide oil glut has increased the competitive pressure of oil and gas and coal to supplant nuclear power as an electrical generation fuel.

The years of decline since 1979 have created a substantial surplus in the mining and milling of uranium. Many mines are operating at a much reduced capacity. Before demand for new mining capacity is realized, a large portion of the existing surplus will have to be absorbed into the world market.

Although the extremely high grade of ore found in the breccia pipes might make these deposits more attractive than more conventional mines, the remote, environmentally sensitive nature of this area would make mining of these pipes more expensive over the long run.

Another impact of the proposal would be on speculative noncompetitive oil and gas lessees, who have historically represented the majority of mineral leasing activity at Lake Mead. However, in the last 20 years, since the establishment of the NRA, no oil and gas wells have ever been drilled on the oil and gas leases that have been issued to date, and no oil and gas deposits have been identified within Lake Mead. Therefore, removal of

most of the NRA from speculative leasing would have a minimal impact on the petroleum industry. A few individuals and corporations would be prevented from acquiring speculative leases in the NRA, and the treasury would lose several thousand dollars annually in lease rental fees. However, because 148,870 acres would still be open to leasing in the NRA, this impact is expected to be minimal.

During the period 1955-1983, applications for over 600 federal leases were reviewed by the NRA. Although less than 200 acres have been disturbed to date, an undetermined portion of which was disturbed prior to recreation area establishment, this widely scattered disturbance has resulted in production of only 60 pounds of tungsten, and the stockpiling of approximately 10 tons of tungsten ore awaiting shipment for processing since 1972. It is not known what grade of ore is stockpiled, nor what amount of tungsten the 10 tons of ore would yield after processing. Mineral leasing in Lake Mead National Recreation Area has not yielded production in commercial amount of any other fossil fuel or nonmetallic or metallic minerals. A study commissioned by the National Park Service in 1982 concluded that the increase in areas excepted from mineral leasing under the proposed action is expected to have no measurable impact on present or future mineral production (O'Brien 1982, see Appendix G).

If elimination of mineral leasing in the recreation area was made subject to valid existing rights, tungsten production from recreation area lands would only be affected by market conditions, the discretion of the leaseholder reserves available, and expiration of the lease. Neither the magnitude nor the absence of past production in an area provides sufficient evidence to establish or downgrade its mineral potential. Only after thorough geochemical and/or geophysical investigations, usually involving core drilling or other subsurface work, can such potential be evaluated. However, of the over 200 leases issued in the recreation area since the beginning of 1972 for the commodities listed below, only one lease has resulted in commercial production.

| | |
|---|---|
| Gold | Pumice |
| Silver | Fluorspar |
| Copper | Titanium |
| Tungsten | Turquoise |
| Sodium | Uranium |
| Perlite | Thorium |
| Oil and Gas | |

Conclusion: It is not anticipated that elimination of mineral leasing in 89 percent of the national recreation area would significantly affect current or future mineral and fossil fuel production locally or nationally.

## IMPACT ON WILDERNESS LANDS

Management zoning under the proposed action would place 109,500 acres in the resource utilization subzone of the special use zone. These lands would be open to mineral leasing. Although no lands are proposed for

wilderness designation, the Wilderness Suitability map in the "Affected Environment" section indicates those lands that meet or potentially meet the criteria of the Wilderness Act of 1964. The following units are keyed by number to that map and include most of the lands in the recreation area that possess primitive characteristics. Boundary lines of the units follow topographic features, access roads, the recreation area boundary line, section lines, and a line marking a 300-foot horizontal setback from the high waterlines of Lakes Mohave and Mead.

Units 1 and 2 (total, 40,605 acres) center on the Newberry Mountains, which rise to an elevation of 5,600 feet and offer a cool refuge from the heat of the surrounding desert lowlands. Davis Dam, the Mohave power plant, Katherine Landing, and Bullhead City are developments visible from the southern and eastern portions of this unit. The resource utilization subzone would include 3,755 acres within these units on the lower alluvial slopes adjacent to the Nellis Wash unit.

Unit 3, Nellis Wash, includes portions of the isolated Newberry Mountains along the western side of the recreation area. Finger-like drainages and alluvial fans extend eastward from the mountains toward Lake Mohave. Some mining has previously occurred within the unit. All of the 15,870 acres within this unit would be placed in the resource utilization subzone under the proposed action.

Unit 4, Cottonwood Valley, potentially meets the criteria of the Wilderness Act in spite of outstanding mineral reservations. This 15,295-acre gently sloping wash provides solitude in a primitive setting just to the north of a major development at Katherine Landing. The resource utilization subzone would include 4,950 acres within this unit at the southern end closest to Katherine Landing.

Unit 5, the Black Mountains capped by 2,000-foot Mount Davis, provides a background for Lake Mohave. Approximately 17,970 acres are included within this unit. Scattered washes and side canyons transect the Black Mountains from east to west as they wend their way to the Colorado River. The resource utilization subzone would include 10,580 acres within this unit in the eastern portion and adjacent to the NRA boundary.

Unit 6, Opal Mountain (17,635 acres), contains a portion of the Eldorado Mountains, gently rolling hills, and outwashes extending to Lake Mohave. Rugged mountains, secluded valleys, and gently sloping alluvial fans provide opportunities for seclusion in a setting of scenic splendor. The resource utilization subzone would include the 8,125 acres of gently sloping alluvial fans behind Opal Mountain and far from the lake.

Units 7, 8, 10, 11, and 12, Fire Mountain and Black Canyon, contain some of the most spectacular and rugged terrain within the recreation area. They consist of steep, barren rocky crags, which begin at an elevation of 645 feet and rise to approximately 2,200 feet. These units consist of 70,470 acres and combine to form the "Black Canyon" of Lake Mohave, which is noted for its hot springs and cool Colorado River. This area is a popular spot for visitors to see sharp and abrupt canyon walls and a myriad of geologic features. Units 11 and 12 only potentially meet the criteria of the Wilderness Act because the Bureau of Reclamation has

identified these areas as potential locations for reclamation facilities ranging from Hoover Dam modifications to new transmission line corridors. The resource utilization subzone would include 11,850 acres within these units that are adjacent to the NRA boundary and are not visible from the lake or major access roads.

Unit 9, Eldorado Mountain, contains approximately 29,665 acres of the picturesque and rugged Eldorado Mountains. The unit is a maze of peaks and side canyons with vertical cliffs extending to the edge of the Colorado River. The resource utilization subzone would include the 4,270 acres immediately north of an active mining area.

Unit 13, Kingman Wash, contains approximately 40,835 acres. The undulating Black Mountains typify the topography of the region. Access to the unit is provided on all sides by existing road corridors. The resource utilization subzone would include the 1,845 acres within the unit adjacent to highway 93.

Unit 14, Bonelli Landing, comprises 13,875 acres of mainly alluvial fans and separates the hilly mountainous area of unit 13 from the gypsum beds of unit 21. This unit contains historic mining diggings and some archeological remains in the form of petroglyphs. Access to this unit is by the road to Bonelli Landing and Temple Bar. None of these lands would be open to mineral leasing.

Units 15, 16, and 17, Pinto Valley, comprise approximately 38,340 acres of rugged hills and highly scenic valleys. These units contain Guardian Peak, which is one of the highest peaks in the area and is used as a navigational aid. The northern side of Boulder Canyon is formed by these units, where steep cliffs or barren rock extend into the cool blue waters of Lake Mead in a dramatic fashion. Pinto Valley is a much-photographed topography, with red sandstone outcroppings that merge with the green desert vegetation and the grays, browns, and yellows of the desert floor. None of these lands would be open to mineral leasing.

Unit 18, Cathedral Wash, contains 18,820 acres. Mountainous terrain representing the northeast extremities of the Black Mountains dominates the area and contrasts with the flat surface of Lake Mead. None of these lands would be open to mineral leasing.

Unit 19, Overton (24,040 acres), consists of flat to "badland-like" lands sloping westward from mountainous terrain to a road corridor east of the recreation area boundary. The unit forms the scenic background for lake users and for shoreline users on the west side of Overton Arm. These flat outwashes lack the spectacular constrasts found in other units and portray a typical desert landscape. This unit has retained its primitive characteristics and affords an opportunity for seclusion and an unconfined type of recreation. None of these lands would be open to mineral leasing.

Unit 21--White Hills, unit 22--Temple Bar, and unit 23--Gregg's Hideout, all in the White Hills offer isolation, scenic views, and historic attractions. This rolling hill country includes some evidence of earlier

mining activities and trails. These activities did not scar the area excessively, and many scars have healed to the point of not being noticeable. Access to the area is possible by car on existing roads, by hiking from developed areas such as Temple Bar, or by boat from Lake Mead. These three units contain approximately 52,130 acres. The resource utilization subzone would include 10,720 acres in units 22 and 23. These areas are remote from the lake and already show some evidence of earlier historic mining activities and trails.

Units 20 and 24-32 are known as Twin Springs, Scanlon Wash, Hiller Mountains, Hell's Kitchen, Indian Hills, Cockscomb, Grand Wash Cliffs, Iceberg Ridge, South Cove, and Pearce Ferry. The units (total 135,688 acres) contain rugged mountain ranges that provide a scenic background for the Virgin Basin section of Lake Mead. Gently sloping outwash fans extend from the mountains to plunge abruptly into the reservoir. The resource utilization subzone would include 9,320 acres within these units--4,200 acres in unit 24 and 5,120 acres in unit 30--all hidden from view of the lake.

Unit 33, Shivwits Plateau, contains approximately 83,980 acres. Diverse activities occur in this remote section of Lake Mead, ranging from hunting to grazing. Due to a higher altitude, the region is cooler, has more precipitation, and supports pinyon/juniper and ponderosa pine forests and a wider variety of wildlife than can be found in the rest of the recreation area. Kelly Point, Twin Point, and other points along the rim permit spectacular views of the Grand Canyon. Because most of the land within this unit is subject to mineral reservations, the unit only potentially meets the criteria of the Wilderness Act. This unit, like several others, appears to be narrow and splintered by access roads. However, when considered along with the adjacent proposed wilderness in Grand Canyon, it is apparent that these would form a significant contiguous wilderness unit. None of these lands would be open to mineral leasing.

Unit 34--Andrus Point, unit 35--Whitmore Point, and unit 36--Lava consist of approximately 58,430 acres in the northeast sector of the recreation area. Contained within these units are Parashant, Andrus, and Whitmore canyons; all are precipitous and scenic side canyons that drain into the Grand Canyon. The entire area is undeveloped land retaining its primeval character, and it provides an opportunity for solitude or a primitive and unconfined type of recreation in a scenic setting of steep escarpments, colorful red walls, and deep canyons. Geologic formations and processes in evidence here might provide information on the origin of the Grand Canyon. Archeological sites of several Indian cultures, including the Virgin Anasazi and more recently the Paiutes, are also found here. Adjacent primitive areas of Grand Canyon National Park provide for a contiguous unit of primitive lands extending westward from the Pine Mountains across the Sanup and Shivwits plateaus to the Grand Wash Cliffs. None of these lands would be open to mineral leasing. See table 28 for a summary of wilderness acres affected.

Conclusion: Designating 148,970 acres as open to mineral leasing within the NRA would affect 76,435 acres, or 14 percent of those lands that meet the criteria of the Wilderness Act, and 4,950 acres, or 4 percent of those lands that potentially meet the criteria. These are lands which primarily meet the roadless requirements of the Wilderness Act and do not possess

Table 28: Summary of the Effects of the Proposed Action on Wilderness Lands

Acres Meeting or Potentially Meeting Wilderness Act Criteria

| | | | Acres Affected | |
|---|---|---|---|---|
| | Wilderness | Potential Wilderness | Wilderness | Potential Wilderness |
| 1 | 7,650 | | | |
| 2 | 32,955 | | 3,755 | 0 |
| 3 | 15,870 | | 15,870 | 0 |
| 4 | 0 | 15,295 | 0 | 4,950 |
| 5 | 17,970 | 640 | 10,580 | |
| 6 | 17,635 | 0 | 8,125 | |
| 7 | 15,145 | | 1,710 | 0 |
| 8 | 25,605 | | 10,240 | 0 |
| 9 | 29,665 | | 4,270 | 0 |
| 10 | 2,045 | | | 0 |
| 11 | 0 | 14,645 | | |
| 12 | 0 | 13,030 | | |
| 13 | 40,835 | | 1,845 | 0 |
| 14 | 13,875 | | | |
| 15 | 17,115 | | | |
| 16 | 6,680 | | | |
| 17 | 14,545 | | | |
| 18 | 18,820 | | | |
| 19 | 24,040 | | | |
| 20 | 10,610 | | | |
| 21 | 25,580 | | | |
| 22 | 16,665 | | 6,145 | 0 |
| 23 | 9,885 | 80 | 4,575 | 0 |
| 24 | 22,095 | | 4,200 | 0 |
| 25 | 8,545 | | | |
| 26 | 14,620 | | | |
| 27 | 7,720 | | | |
| 28 | 14,020 | | | |
| 29 | 13,895 | | | |
| 30 | 15,143 | 460 | 5,120 | 0 |
| 31 | 16,480 | | | |
| 32 | 12,100 | | | |
| 33 | 0 | 83,980 | | |
| 34 | 14,905 | 0 | | |
| 35 | 32,215 | 0 | | |
| 36 | 10,710 | 600 | | |
| Totals | 545,645 | 128,730 | 76,435 | 4,950 |
| Percentage | 100 | 100 | 14 | 4 |

outstanding natural beauty or other significant resource values. Mining activities as a result of mineral leasing in these areas could unnaturally scar the landscape and alter the wilderness character of these lands, making wilderness values on at least part of these lands lost to any future possible designation.

## IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

If a flood caused the death of one or more individuals, such a loss would be irreversible and irretrievable. Likewise, flooding has the potential to cause injuries that would result in irreversible and irretrievable damage to the person as well as to a person's capability to participate in some activities.

Destruction of up to 500 acres of lithosols and red desert soils from development of NPS and concessioner structures, and damage and erosion of soils from offroad vehicles, would be irretrievable losses of these soils.

Irretrievable losses and damage to soils might result from mineral exploration activities. Exploration activities associated with prospecting permits and oil and gas leases could result in damage to soils through excavation and erosion, with additional losses expected from associated excavation and removal for road construction and similar earthwork. Soil nutrients that have developed over long periods of time could be reduced in these disturbed soils by exposure of the soils to erosion and accelerated weathering while soil compaction and abnormally high soil temperatures could also occur. All factors could reduce the reclamation potential of the disturbed area unless proper care was taken to mitigate soil loss. Under the proposed action, soil loss caused by exploration and development over the next 10 years would be expected to be fewer than 300 acres provided that present mineral development trends in the area continued.

Irreversible and irretrievable loss of vegetation could result from implementation of the proposed action. In the unlikely event that an ore deposit was discovered and a mine began to produce, several hundred acres of vegetation could be destroyed through development of mine surface facilities, access roads, and tailings piles. Whether vegetation could be reestablished would depend on the success of mitigation designed to maintain the productivity of the soil. Reclamation of mined areas would take a minimum of 50 to 75 years.

Exploration or mining activities as a result of mineral leasing could irretrievably scar the landscape and alter the wilderness character of lands that meet the criteria for wilderness.

## SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

Under the proposed action money would be expended to place development in areas that are known to be prone to flooding. Facilities would be protected by structural measures to the level of the 100-year flood. No

protection from the probable maximum flood would be provided to structures. Warning systems and evacuation plans would be developed to protect human life in the event of a 100-year or probable maximum flood. The premise underlying the proposed action is that the chance of the a probable maximum flood occurring is so slight that the expenditure to protect structures against this flood is not justified. Over the long term, there is a chance that structures and human lives might be lost as the result of a probable maximum flood.

Removal of the Shivwits Plateau from any further mineral leasing consideration would favor long-term provision of recreational benefits over short term economic and energy supply gains. Among the benefits provided by Lake Mead National Recreation Area are public recreation, and preservation of scenic, historic, and other important features. Opportunities for primitive, secluded, backcountry experiences on the Shivwits Plateau or in the esplanade and canyon country of the Whitmore-Parashant Canyon area would not be compromised. The highly speculative nature of the mineral resources within the NRA indicates that the long-term gains obtained from preserving the recreational values of the park far outweigh the uncertain, relatively short-term gains from mineral development.

Approximately 500 acres of soil and vegetation would be lost to provide additional recreation benefits for six million to nine million people per year who visit Lake Mead National Recreation Area.

In the event that mining did occur in the recreation area with concomitant destruction of several hundred acres of soil and vegetation, these recreational resources owned by the nation would be lost in exchange for the economic gain of shareholders of the mining company. Other industries might benefit from the development of the mineral resources. Over the long term--no less than 50 to 75 years--productive soils and vegetation might be restored in mined areas through reclamation.

## ADVERSE IMPACTS THAT COULD NOT BE AVOIDED

In the event of a probable maximum flood occurring under the proposed action, the survival of people within the probable maximum floodplain would depend on the adequacy of the warning system and the evacuation plans, and on the actions taken by themselves and other people in attempting to evacuate the area. National Park Service and concessioner structures probably would be lost. Personal property of visitors such as vehicles probably would be lost.

There is a possibility that increased visitor numbers (about 1.35 times current levels) would increase the level of currently experienced adverse impacts on water quality. Actions such as moving swim beaches at several developed areas might prevent these potential adverse effects from materializing. Should water quality deteriorate below the level required by state standards, some swim beaches and coves might have to be closed to use. There is a possibility that shoreline users would contract diseases from contaminated water.

Indirect impacts such as pollution of springs and trampling of vegetation could be aggravated by increased visitor use at Rogers and Bluepoint springs. Under all alternatives, visitation to these special communities is expected to increase by about 38 percent. The difference is that under the no-action alternative and alternative A, there would be no addition of visitor facilities, while under the proposed action and alternative B, additional facilities would be provided and monitoring would be done. The monitoring and subsequent management action under the proposed action is expected to stop adverse impacts as soon as they occurred.

Destruction of up to 500 acres of lithosols and red desert soils from development of NPS and concessioner structures, and damage and erosion of soils from offroad vehicles would be an unavoidable adverse impact on soils. There would be unavoidable adverse impacts on soils in the form of losses and damage from exploration activities. Exploration activities associated with prospecting permits and oil and gas leases could result in damage to soils through excavation and erosion, with additional losses expected from associated excavation and removal for road construction and similar earthwork. Soil nutrients that have developed over long periods of time could be reduced in these disturbed soils by exposure of the soils to erosion and accelerated weathering while soil compaction and abnormally high soil temperatures could also occur. All factors could reduce the reclamation potential of the disturbed area unless proper care is taken to mitigate soil loss. Under the proposed action, soil loss caused by exploration and development over the next 10 years is expected to be fewer than 300 acres, provided that present mineral development trends in the area continued.

In the unlikely event that an ore deposit was discovered and production of a mine was initiated, at least several hundred acres of vegetation could be destroyed.

Trailer village residents at Willow Beach where 50 long-term residents would be relocated to a safer area approximately a half mile away would experience the inconvenience associated with moving. Removal of four long-term sites at Overton Beach and 10 long-term sites at Temple Bar would adversely affect a total of 14 (2 percent) of the 887 long-term sites in the recreation area. To mitigate the effect on these long-term residents, they would first be reduced by attrition. However, some long-term residents would have to relocate to another developed area or outside the recreation area. Only seven out of the NRA total of 297 or 2 percent of short-term sites would be removed.

The national recreation area has 545,645 acres of land that meet the criteria for wilderness and 128,730 acres that potentially meet these criteria. Under the proposed action 76,435 acres that meet the criteria for wilderness (14 percent of the NRA's total that meet the criteria) would be open to mineral leasing; 4,950 acres (4 percent of the NRA's total acres that potentially meet the criteria) would be affected. Exploration or mining activities as a result of mineral leasing could scar the landscape and alter the wilderness character of these lands, making wilderness values on at least part of these lands lost to any future possible designation. These are lands that primarily met the roadless requirements of the Wilderness Act criteria and do not contain other significant resource values.

## ENVIRONMENTAL IMPACTS OF THE NO-ACTION ALTERNATIVE

A summary of the following impacts is presented in the "Summary" section at the beginning of this document.

### IMPACT ON PUBLIC SAFETY IN FLOODPLAINS

Many areas in the recreation area are subject to flash flooding. The 100-year flood has a 1 percent chance of occurring in any year. The probable maximum flood is the greatest flood that could ever be expected. Probable maximum floods do occur, but the frequency is uncertain; and the likelihood in any year is less than 1/10 of 1 percent. Flooding is most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor use facilities are out of the floodplain. At Boulder Beach all development is on a broad alluvial fan, with protection provided by earth dikes. Also, since flooding at Boulder Beach takes the form of sheet flows up to 2 feet in depth, it is not considered to present as great a danger to human life or property as the concentrated flows in canyons at other areas of the NRA; therefore, no potential victims or damage to structures are shown for Boulder Beach in the impact sections relating to floodplains. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain. See the discussion of floodplains and wetlands in the "Affected Environment" section of this document for a more detailed explanation of floodplains. The development concept plan graphics for each developed area show the extent of the 100-year and probable maximum floods.

The number of people in the probable maximum floodplains of the developed areas of the recreation area on an average summer weekend has been estimated at 4,845 during the day and 4,870 at night. A breakdown by developed area is shown in table 24. This number of people in the probable maximum floodplain represents approximately 5 percent of the people in the recreation area on a summer weekend day (96,000). About 1,250 people during the day and 1,225 at night are in the 100-year floodplain on an average summer weekend (see table 23). These numbers are about 1 percent of the people in the recreation area.

Flood mitigation in the no-action alternative would rely mainly on the nonstructural methods of the warning system package discussed in the proposed action and minor maintenance actions, such as regrading of dikes and channels. A few facilities would be removed or relocated from the floodplain.

The specific flood mitigation actions that would occur at each developed area are described below.

> Katherine. The transient trailers (#17 DCP graphic) would be removed from the north Katherine Wash area, and the area would be regraded. The existing diversion canal above the access road would be regraded to divert flood flow into Telephone Cove. The warning system package would be installed.

Cottonwood. Existing drainage canals and the warning system package would be maintained.

Willow Beach. The existing warning system package would be maintained; facilities now closed would remain closed.

Boulder Beach. Existing diversion dikes and channels would be maintained and the warning system package would be installed.

Las Vegas Wash. The launch ramp and parking would be protected through nonstructural measures. Dry boat storage and concession maintenance would be relocated. A warning system package would be developed for the launch ramp in the floodplain.

Overton Beach. The campground would be relocated out of the flood-hazard zone.

Temple Bar. The existing diversion dikes and channels would be maintained and the warning system package would be installed.

Removal of facilities from the floodplain would provide the best protection from floods. The warning system would be the second most effective method of reducing the number of flood victims, assuming that it operated correctly and provided a signal in advance of the flood, that people received the signal and responded appropriately, and that the evacuation plan was effective.

While diversion structures would normally be more effective than warning systems, the existing earth dikes and channels are so unsound that they would provide essentially no protection. People would see the diversion dikes and channels and feel a false sense of security because flood protection measures appeared to be in place. At Cottonwood Cove and Temple Bar the 100-year floodplain was mapped assuming that the existing earth dikes and channels would withstand such a flood. The structures would not likely do that, and their failure would jeopardize large numbers of people in campgrounds, trailer villages, etc., at Cottonwood and Temple. Thus, the estimate of the number of people who would be in the floodplain in those areas is unrealistically low.

At the Katherine developed area the potential number of people in the probable maximum floodplain would be reduced by about 65 during the day and 100 at night by removing the short-term trailer village sites. The safety of the remaining 1,030 people in the probable maximum floodplain would depend on the warning system.

There would be no change at Cottonwood Cove, since a warning system is already in place. Therefore, there would be no impact on visitor safety in floodplains.

There would similarly be no change at Willow Beach. However, the warning system that is already in place is less effective than warning systems at other areas. It only gives notice of an impending flood approximately 20 minutes before the flood strikes. Flood conditions develop relatively rapidly at Willow Beach because water concentrates very

quickly in its steep canyons. Floods are difficult to flee at Willow Beach because steep canyons make escape to higher ground difficult. Road access to the area is severed during most floods because the access road follows a narrow canyon bottom.

Installation of warning systems at Las Vegas Wash and Temple Bar would improve the safety of about 1,210 people in the probable maximum floodplain. Due to the shallow sheet-flow-type flooding at Boulder Beach there is little hazard to people in the floodplain, and it has been excluded from the tables. However, a warning system would be installed to even further reduce the hazard for the 1,260 people in the probable maximum floodplain.

At Overton Beach the campground would be relocated out of the floodplain, eliminating the hazard for about 275 people during the day and 350 people at night.

Conclusion: The no-action alternative would provide additional protection to approximately 2,620 occupants of the probable maximum floodplain and 685 occupants of the 100-year floodplain through installation of warning systems. The degree of hazard would depend on how well the warning systems and evacuation plans worked. During a large flood event it is likely that injuries or fatalities would result.

## IMPACT ON PROPERTY IN FLOODPLAINS

Many areas in the recreation area are subject to flash flooding. Flooding is most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor use facilities are out of the floodplain. At Boulder Beach, all development is on a broad alluvial fan, with protection provided by earth dikes. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain. A more thorough discussion of floodplains may be found in the "Affected Environment" section of this document. The development concept plan graphics for each developed area show the extent of the 100-year and probable maximum floods.

Table 20 shows development in the floodplain under each alternative, including no action. The no-action alternative would keep existing structures in their present locations. Protection of these structures would be enhanced somewhat by regrading dikes and channels, but warning systems added to protect human occupants would not provide any protection to property in the floodplain. Consequently, this property would remain susceptible to flood damage. The cost of replacing structures left unprotected in the 100-year floodplain would be approximately $6.6 million; and for replacing those in the probable maximum floodplain, approximately $20.4 million. These costs would not cover utilities, furnishings, equipment, vehicles, flood-control devices, debris removal, search and rescue, or expenses of victims.

Conclusion: Under the no-action alternative, the 100-year or probable maximum flood would damage or destroy a large number of structures.

## IMPACT ON RESERVOIR WATER QUALITY

Based on available data, water quality in Lakes Mead and Mohave is generally in compliance with established standards throughout the year. However, in isolated instances bacteriological pollution threatens the use of water for full body contact recreation. The pollution source is improperly disposed of human waste from visitors using the shoreline zone around the lakes. Concentrations of visitors at swim beaches or popular coves increases the probability of pollution. The health risk occurs during activities like swimming and waterskiing, when water may be ingested accidently and certain sensitive body organs (e.g., eyes and nose) might be exposed to water.

The allowable maximum limits for fecal coliforms (measure of bacteriological pollution in units/100ml) for full body contact recreation in the Arizona and Nevada water quality standards are 200 as a geometric mean (5 sample minimum), 400 in 10 percent of samples for a 30-day period, and 800 in a single sample.

Elevated counts of fecal coliforms generally occur during heavy use days (such as Labor Day), when lake levels are low, and at undeveloped coves accessible only by water where use is low to moderate and no sanitary facilities are available. In the latter case, localized incidents of high fecal coliforms occur when water levels rise and such areas are inundated. Bacteriological pollution is rare in open areas (such as Boulder Beach) where wind and wave action provide adequate mixing; however, in areas where beaches are located in harbors or confined areas, incidents of elevated coliform counts are common by late summer. For example, fecal coliform levels have reached 1,200 at Cottonwood Cove, 1,100 at Temple Bar, and up to 24,000 in Las Vegas Bay (pollution from Las Vegas discharged from Las Vegas Wash into Lake Mead).

Water quality at designated swimming beaches in Lake Mead NRA is regularly monitored in accordance with applicable state and local health codes to identify unsafe water quality conditions. When potentially unsafe conditions are noted, the particular area is more closely monitored and may be closed to public use. The Las Vegas Wash harbor has been closed since 1976, and several heavily used shoreline areas, like the swimming beaches at Katherine, have had conditions on several occasions that nearly dictated their closure.

The no-action alternative does not propose any actions that would change shoreline visitation patterns and thereby alter water quality. The existing conditions just described would be expected to get worse over the life of the plan as visitation increased. Over the life of this plan visitation would be expected to increase to about 1.35 times the current levels. The mathematical correlation between visitor use and associated pollution cannot be determined with existing data, so the levels of pollution cannot be projected. Temporary swim beach closures or closures of popular coves might become necessary if levels of bacteriological pollution were to exceed state standards.

There would be an increased risk of shoreline users contracting diseases from contaminated water, but the degree of increase cannot be

determined. The water quality monitoring program should make this risk insignificant by continuing to assess the risk and determining when remedial actions are necessary. Up to now there have not been any recorded cases of serious infectious diseases being contracted from contact with Lake Mead's water. The monitoring program is explained in the shoreline pollution section of the proposed action.

Conclusion: Even with expected increases in visitation, the no-action alternative would not pose significant health hazards from water pollution.

## IMPACT ON DESERT SPRING ECOLOGICAL COMMUNITIES

The Significant Natural Features map identifies 33 springs and seeps within the NRA. Rogers and Bluepoint springs are unique warm water springs. They contain native and exotic fish, provide suitable habitat for waterfowl and shorebirds during their migrations, contain aquatic and emergent vegetation, and provide a rare moist habitat and water source for small mammals, reptiles, amphibians, and nesting birds. While such desert spring ecological communities are rare and important habitats, they are not as critical as they once were because the reservoirs provide some comparable shoreline habitat. Spring communities amount to less than 100 acres or less than .01 percent of the recreation area. Rogers and Bluepoint springs amount to less than 10 acres. The existing picnic areas at Rogers and Bluepoint springs would remain under the no-action alternative. Rogers Spring has a 0.4-mile gravel access road, unpaved parking for about 10 vehicles, two picnic shelters with tables, and pit toilets. Bluepoint Spring has a small parking area and two picnic tables. Paths have formed around both springs from visitor use.

Impacts on the spring communities surrounding Rogers and Bluepoint springs would result from increased use by visitors. If visitation to these springs increased 38 percent, as projected for the recreation area over the life of the plan under existing conditions, the foot paths around the springs would be expected to increase by at least that much. Emergent vegetation and other moist terrestrial vegetation would be destroyed, and the spring water could be polluted by improperly disposed trash and human waste. The degree of these impacts cannot be determined, but impacts on the moist terrestrial vegetation habitat could result in damage or destruction to a fourth or more of rare habitat around these two springs.

Under this alternative, five springs could be affected by uranium mining if the current prospecting applications were approved and mining occurred. The no-action alternative would allow the continued consideration of mineral leasing in all management zones of the recreation area, outside those excepted by current regulation. Thus, 78 percent of the recreation area, or 1,162,550 acres, would be open to leasing consideration. Mineral development activity would be expected to continue according to past historical trends and would not be expected to change. Due to few known mineral resources within the recreation area, little activity would be expected. If the no-action alternative was selected approximately 32,600 acres, or 2 percent of the recreation area land, could potentially come under lease within the first year (approximately 30

prospecting permit applications totaling 11,640 acres are being held by the BLM pending completion of the planning documents for the NRA). Over half the acreage under application is in the Shivwits Plateau area, 5,840 acres are in the Gold Butte area, and the remaining 10,000 acres are scattered around the recreation area in smaller parcels. Since leasing is primarily speculative within the NRA, it is difficult to estimate how much of the new leased land would be significantly disturbed by mineral development.

Most of the springs in the area originate in the lower portion of the Supai formation and could be connected with nearby breccia pipes which extend upwards from the Redwall limestone, through the Supai Formation, into the Toroweap formation. The potential for adverse impacts on these springs from mine development would be greatest where the springs are perennial in nature. It is believed that breccia pipes are capable of transmitting groundwater from the upper perched aquifers (such as the Supai springs) to the undefined aquifers in the Redwall formation. Although there may be natural movement of water through the pipes, mine development could dramatically increase this exchange between formations, leading to two significant impacts on local groundwater resources. First, the partial dewatering of a given pipe from mine development could result in significant reduction or complete loss of flow from seeps and springs that support sensitive ecosystems. Second, contamination of groundwater sources in the Redwall limestone could result from post-operational mine water, leachate from ore stockpiles, accidental spills, and discharges from fuel tanks. The mining of the high-grade ore in the breccia pipes would mobilize the ionic and metallic elements in the low-grade deposits that would not be removed during mining, thereby creating a potential for groundwater contamination when natural aquifer conditions were reestablished upon mine closure. Although arid to semiarid conditions exist throughout the Shivwits Plateau, the potential for leachate production from the ore stockpiles still exists. Impacts on Cedar Spring could be especially serious because it is less than ¼ mile from the known Lone Mountain breccia pipe, an important link in the groundwater transmission system. The proximity of the other four springs to breccia pipes is not known. Although the 1966 excepted areas exclude all lands within ¼ mile of any spring or seep from mineral leasing, these resources might still be affected by mining activities because of hydraulic connections between the springs and seeps and breccia pipes.

Conclusion: The no-action alternative would not directly affect Rogers and Bluepoint springs, but impacts from increasing visitor use could result in trampled vegetation or polluted waters. These impacts could easily damage or destroy a fourth or more of the moist vegetation habitat around these springs. The no-action alternative could have significant adverse impacts on at least five of the 33 springs that support sensitive desert ecological communities, should uranium mining occur.

## IMPACT ON SOILS

Soils of the recreation area are extremely variable. Climate, vegetation, parent material, elevation, slope, and aspect affect the development of these soils, which are characterized by a wide range of physical and

chemical properties. Texture, permeability, depth, stoniness, organic content, alkalinity, and other properties are highly diverse and change quickly within short distances.

Under the no-action alternative, soil damage resulting from offroad vehicle use would continue. The passive offroad vehicle control elements of the proposed action would be implemented, but lakeside roadways would not be constructed at the ends of approved roads. No new additional access point roads would be added along the reservoirs. Also, there would be no new major developments on the lake to relieve pressure on currently overcrowded areas. The area heavily damaged by offroad vehicles in the Boulder Basin zone would be used for rehabilitation research, but no program would be developed for application of successful methods elsewhere in the recreation area. The roadways and facilities of the proposed action and alternatives A and B would not be built.

Because the no-action alternative would not provide additional outlets for offroad vehicle use and additional access to the lake, offroad vehicle drivers would be expected to continue damaging soils along the reservoirs in attempts to reach less crowded areas. Offroad vehicle driving would damage slightly less than the 30 to 40 acres per year that are currently damaged. Damaged soils in the recreation area would double to about 700 acres in a decade, and these soils would remain damaged permanently because of a lack of restoration activities.

The no-action alternative would allow the continued consideration of mineral leasing in all management zones of the recreation area, outside those lands excepted by current regulation. Thus, 78 percent of the recreation area, or 1,162,550 acres, would be open to leasing consideration. Mineral development activity would be expected to continue according to past historical trends and would not be expected to change. Due to few known mineral resources within the recreation area, little activity is expected. If the no-action alternative was selected, approximately 32,600 acres, or 2 percent of the recreation area, could potentially come under lease within the first year (approximately 30 prospecting permit applications totaling 11,640 acres are being held by the BLM pending completion of the planning documents for the NRA). Over half the acreage under application is in the Shivwits Plateau area; 5,840 acres are in the Gold Butte area; and the remaining 10,000 acres are scattered around the recreation area in smaller parcels. Since leasing is primarily speculative within the NRA, it is difficult to estimate how much of the new leased land would be significantly disturbed by mineral development.

Impacts on soils from mineral leasing under the no-action alternative would be expected to be greatest in the Shivwits Plateau area, where nearly 17,000 acres of land could come under lease for uranium exploration if pending prospecting permit applications were approved. Development of the 10 known breccia pipes in the Shivwits area could result in the direct loss of 400 to 500 acres of soils through excavation and erosion, with additional losses expected from associated excavation and removal for road construction and similar earthwork. Soil nutrients that have developed over long periods of time would be reduced in these disturbed soils by erosion and accelerated weathering; soil compaction and

abnormally high soil temperatures could also occur. The reclamation potential of the disturbed areas would be reduced unless proper care was taken to mitigate soil loss. Because of the diversity of soils in the recreation area, site-specific soils data would be necessary for detailed impact assessment and reclamation planning before mining approval.

Mineral leasing would not be expected to significantly affect soil in the remaining areas of the park. Some damage or loss could be expected from sporadic exploration activities; however, the amount of acreage affected would likely be less than 300 acres over the next 10 years if the present mineral development trends continued in the area.

Conclusion: Under this alternative, offroad vehicle driving would damage about 350 acres of soils over the life of the plan. There would be no new destruction or damage to soils from construction and no increases in soil erosion from runoff from impervious surfaces. Further, no fill material would have to be imported into the recreation area, and existing soil surfaces would not be covered. Mineral leasing activities could result in the loss of soils on more than 500 acres on the Shivwits Plateau; effects in other areas would not be expected to be significant.

## IMPACT ON SIGNIFICANT NATURAL FEATURES

Significant natural features include unique geological areas, outstanding scenic vistas, outstanding coves, and areas zoned as environmental protection areas or outstanding natural features. Only scenic vistas would be impacted by the activity occurring under this alternative. Outstanding scenic vistas are important because they contribute to the overall visual quality of the NRA. Preservation of the high visual quality found in the NRA has been identified as integral to preserving a high-quality recreational experience. In the Shivwits area, Whitmore and Kelly points provide the only overlooks of the lower Grand Canyon region. From Whitmore Point the views include several intervening levels, each a platform or terrace of irregular width, that rise one above the other in precipitous steps hundreds of feet in height. The facades of the cliffs separating the terrace levels are majestic walls or murals that form dramatic visual features.

The only potential source of impacts on scenic vistas would be mineral leasing. The no-action alternative would allow the continued consideration of mineral leasing in all management zones of the recreation area, outside those lands excepted by current regulation. Thus, 78 percent of the recreation area, or 1,162,550 acres, would be open to leasing consideration. Mineral development activity would be expected to continue according to past historical trends and would not be expected to change. Due to few known mineral resources within the recreation area, little activity would be expected. If the no-action alternative was selected, approximately 32,600 acres, or 2 percent of the recreation area, could potentially come under lease within the first year (approximately 30 prospecting permit applications totalling 11,640 acres are being held by the BLM pending completion of the planning documents for the NRA). Over half the acreage under application is in the Shivwits Plateau area; 5,840 acres are in the Gold Butte area; and the remaining 10,000 acres

are scattered around the recreation area in smaller parcels. Since leasing is primarily speculative within the NRA, it is difficult to estimate how much of the new leased land would be significantly disturbed by mineral development.

Uranium development in the Shivwits area would be the most likely mineral activity to take place within the near future. In the Parashant and Whitmore Canyon areas, uranium development would lead to significant degradation of the scenic vistas from Whitmore Point because most of the activity would take place in the immediate foreground of the views from the point.

Sporadic oil, gas, and mineral exploration in other parts of the NRA would not likely cause significant impact to the scenic vistas because of stringent lease application review procedures designed to protect visual quality.

Conclusion: Uranium development of the Shivwits Plateau could significantly degrade scenic vistas from Whitmore Point.

## IMPACT ON THREATENED OR ENDANGERED SPECIES

The endangered bonytail chub, Gila elegans, and the threatened bald eagle, Haliaeetus leucocephalus, are the only two federally listed animal species that are known to occur within Lake Mead. There are no threatened or endangered plant species, proposed species, or critical habitats in the NRA.

There are several federal candidate species that do, or could, inhabit or visit the recreation area. Some of these species are also listed by the states of Arizona and Nevada as threatened or endangered species or species of concern. Table 18 identifies the status and legal classification of all threatened, endangered, or other rare species. Of the 20 species, 18 are known in the recreation area. Of the 18, six are rare migratory transients with wide distributions outside the area. Thus, only 12 are of primary concern.

The only potential source of impacts on threatened or endangered species could be mineral leasing. The no-action alternative would allow the continued consideration of mineral leasing in all management zones of the recreation area, outside those lands excepted by current regulation. Thus 78 percent of the recreation area, or 1,162,550 acres, would be open to leasing consideration. Mineral development activity would be expected to continue according to past historical trends and would not be expected to change. Due to few known mineral resources within the recreation area, little activity would be expected. If the no-action alternative was selected, approximately 32,600 acres, or 2 percent of the recreation area, could potentially come under lease within the first year (approximately 30 prospecting permit applications totalling 11,640 acres are being held by the BLM pending completion of the planning documents for the NRA). Over half the acreage under application is in the Shivwits Plateau area; 5,840 acres are in the Gold Butte area; the remaining 10,000 acres are scattered around the recreation area in smaller parcels.

Since leasing is primarily speculative within the NRA, it is difficult to estimate how much of the new leased land would be significantly disturbed by mineral development.

Sensitive plant or animal species could occur in nearly any of the 78 percent of the NRA that would remain open to mineral leasing consideration under this alternative. Specific locations of each species would be determined during the review process for lease applications. Mineral development proposals under the no-action alternative would most likely involve the Shivwits portion of the NRA. Prospecting permit applications currently on file for uranium total nearly 12,000 acres. In addition, seismic exploration for oil and gas resources could occur throughout the NRA, but it would be most likely in three locations where existing leases are concentrated: the Grand Wash Cliffs, an area south of Temple Bar, and the west side of the Overton Arm south to Pinto Valley.

The impacts of mineral leasing on threatened or endangered species would include direct elimination of individuals or populations through mechanical means, destruction of habitat (or potential habitat), and indirect impacts on reproduction and foraging caused by noise and human presence. Also, harassment or illegal shooting of animals might result from the increased accessibility associated with new road construction or improvement of existing roads.

If threatened or endangered species were known to occur, or were suspected to occur, on lands encompassed by a lease or permit application, appropriate stipulations would be applied to protect these species. If the area was of critical concern to the species, the application might be denied. For officially listed species, a biological opinion would be obtained from the U.S. Fish and Wildlife Service. A "will effect" or "may effect" determination might result in denial of a lease application. If the lease was approved, adequate stipulations would be required to protect the species.

Because the Shivwits Plateau area has only one plant species that is a candidate for federal protection and no known threatened or endangered animals, impacts on threatened or endangered species in that area would not be significant. Several candidate threatened or endangered plants are found on the west side of the Overton Arm, and known gila monster habitat occurs in the vicinity of Rogers and Bluepoint springs; however, impacts on these species from oil and gas seismic exploration would not be significant.

Conclusion: This alternative would have the greatest potential for impact on threatened or endangered animal or candidate plant species because 78 percent of the NRA would be open to consideration of mineral leasing. However, these effects might be mitigated by case-by-case environmental assessments of each lease application. Existing leases and pending permits do not occur in areas that pose a significant threat to threatened or endangered species.

## IMPACT ON VEGETATION

Approximately 71 percent of the NRA is dominated by the creosotebush community. This community type is widespread throughout the desert southwest and is the representative low elevation vegetation type in the Mohave and Sonoran deserts. Vegetation typical of higher elevations, such as in the Shivwits portion of the NRA, includes blackbrush, sagebrush, and pinyon/juniper. These vegetation types are common throughout the intermountain region.

Precipitation rates in low elevation communities are generally less than 5 inches annually, while higher elevations receive 5 to 15 inches. Because of these low precipitation rates, revegetation rates on disturbed sites may be as much as 50 to 75 years.

Impacts to vegetation could occur from mineral leasing under the no-action alternative. This alternative would allow the continued consideration of mineral leasing in all management zones of the recreation area, outside those lands excepted by current regulation. Thus, 78 percent of the recreation area, or 1,162,550 acres, would be open to leasing consideration. Mineral development activity would be expected to continue according to past historical trends and would not be expected to change. Due to few known mineral resources within the recreation area, little activity would be expected. If the no-action alternative was selected, approximately 32,600 acres, or 2 percent of the recreation area, could potentially come under lease within the first year (approximately 30 prospecting permit applications totaling 11,640 acres are being held by the BLM pending completion of the planning documents for the NRA). Over half the acreage under application is in the Shivwits Plateau area; 5,840 acres are in the Gold Butte area; and the remaining 10,000 acres are scattered around the recreation area in smaller parcels. Since leasing is primarily speculative within the NRA, it is difficult to estimate how much of the new leased land would be significantly disturbed by mineral development.

Impacts would be expected to be greatest in the Shivwits Plateau area where nearly 12,000 acres of land could come under lease for uranium exploration if pending prospecting permit applications were approved. In addition, sporadic exploration activities associated with oil and gas leases might occur throughout the NRA. Current interest is in three areas; the Grand Wash Cliffs, south of Temple Bar, and the west side of the Overton Arm south to Pinto Valley.

The primary impact to vegetation resulting from activities proposed on leases or prospecting permits would be direct removal of plants. Blading of areas for location of access roads, drill pads, or mine facilities would result in local destruction of vegetation on approximately 50-100 acres for each surface mine, and less than 5 acres for each oil and gas seismic exploration line. Other impacts would occur due to covering of vegetation with spoil materials, diversion of drainage channels, or potential unauthorized offroad use.

Whenever native vegetation was removed from a site through physical means, the disturbed site would sparsely revegetate with a variety of invader species, including several exotic species such as puncture vine

(Tribulus terrestis) and Russian thistle (Salsola sp.) Propagation of these exotic invaders on large disturbed sites in remote areas would provide a large seed source for introduction of undesirable species into the surrounding native communities. The invading species would also be better adapted to disturbed sites and would out-compete native plants unless an active reclamation program utilizing native species was employed on each disturbed area.

Reclamation of disturbed areas with native species in arid environments would be extremely difficult, particularly in lower elevations. It is unlikely that disturbed areas could be restored to natural conditions in less than 50 to 75 years. Therefore, the loss of vegetation and its indirect effects on wildlife habitat, soil stability, surface erosion, and visual effects would be prolonged for the period of reclamation establishment.

Conclusion: Because the history of leasing in Lake Mead has been primarily speculative and has resulted in almost no surface disturbance in 20 years, the likelihood of future mineral activity is remote. If oil and gas seismic exploration were to proceed, the amount of vegetation lost throughout the NRA would not be significant. If a uranium mine were developed in the Shivwits area, the effect would be locally significant because of the destruction of vegetation in that currently pristine area.

## IMPACT ON DESERT BIGHORN SHEEP

Desert bighorn sheep inhabit many areas within the recreation area and their habitat requirements are quite crucial. Some herds, for example in the River Mountains, are among the most productive in the region. Bighorn are significant because of their value as game species, for visitor viewing enjoyment, and as a source of animals used to restock depleted desert bighorn range.

The no-action alternative would allow the continued consideration of mineral leasing in all management zones of the recreation area, outside those lands excepted by current regulation. Thus, 78 percent of the recreation area, or 1,162,550 acres, would be open to leasing consideration. Mineral development activity would be expected to continue according to past historical trends and would not be expected to change. Due to few known mineral resources within the recreation area, little activity would be expected. If the no-action alternative was selected, approximately 32,600 acres, or 2 percent of the recreation area, could potentially come under lease within the first year (approximately 30 prospecting permit applications totaling 11,640 acres are being held by the BLM pending completion of the planning documents for the NRA). Over half the acreage under application is in the Shivwits Plateau area; 5,840 acres are in the Gold Butte area; and the remaining 10,000 acres are scattered around the recreation area in smaller parcels. Since leasing is primarily speculative within the NRA, it is difficult to estimate how much of the new leased land would be significantly disturbed by mineral development.

Any oil, gas, and mineral exploration activity in Pinto Valley could cause some impact on identified bighorn sheep habitat. Seismic exploration

could cause increased stress on the herd due to increased human presence and noise from blasting and vehicle travel. Continued stress in bighorn populations elsewhere has led to population die-offs because of increased susceptibility to disease organisms. Careful alignment of seismic lines, placement of remote recorders by hiking into sites, and timing of operations should reduce this threat.

To mitigate impacts to bighorn sheep populations if mineral leases have active mineral operations taking place on them, a quarterly population and distribution survey would be conducted on those leases and the adjacent lands inhabited by the bighorn. A program to collect and record the data needed for this type of survey is being developed by the Cooperative National Park Resources Studies Unit, University of Nevada, Las Vegas. This program will gather baseline population data and annual herd movements for all sheep populations near mineral leases, so that any changes from the normal patterns can be easily identified.

All operations that would occur within known lambing areas would contain a stipulation preventing operations from taking place during the lambing period (normally late December to early April). If significant detrimental impacts to a bighorn populations from exploration or mining operations were found, a temporary shutdown of operation would be made until corrective actions could be made to prevent further detriment to the herd.

Conclusion: If exploration activities remained sporadic, as in the past, impacts to the sheep population should not be significant enough to affect overall population health.

## IMPACT ON VISITOR CROWDING/CONGESTION

Existing conditions at the developed areas are extremely crowded and congested on weekends during the summer. Holiday weekends are the worst. Memorial Day weekend has had visitation of 254,000. Annual visitation is around 6.5 million and expected to increase to around 9 million by the year 2000. Currently it is not unusual for visitors at several of the larger developed areas to wait up to an hour to launch their boats and twice that long on a holiday weekend. Several of the popular campgrounds and motels are full during the summer. At several developed areas confusing circulation systems frustrate first-time visitors from easily finding their way around. Illegal parking along road shoulders is a common problem that results when existing parking areas fill.

The no-action alternative does not propose any solutions to crowding/congestion problems. (For a full discussion of the no-action alternative proposals, refer to the "Development Concept Actions" section.) Over the life of the plan visitation is expected to increase by about 68 percent. Because this alternative does not propose any actions to solve crowding/congestion problems, the problems also expected to increase by 68 percent. Crowding/congestion would most likely be significantly worse than that figure because of the way circulation, parking, and overnight accommodation problems compound themselves. The visitors' aggravation and frustration would increase greatly as it took

longer to launch boats and became more difficult or impossible to find legally authorized parking spaces and overnight accommodations. Visitation would probably not increase as much as projected because visitors would have such bad experiences that they wouldn't come back as often and would tell friends to stay away.

Conclusion: Because none of the visitor use problems would be solved, crowding/congestion would increase significantly above existing levels. Crowding/congestion would diminish visitor experiences so much that visitation would probably not increase as much as projected.

## IMPACT ON VACATION CABIN SITE RESIDENTS

Lake Mead NRA has three lakefront areas in which sites may be leased for privately owned vacation cabins. These areas are Katherine Landing, which has 39 cabin sites, Stewarts Point, which has 60 cabin sites, and Temple Bar, which has 36 cabin sites. Cabin site occupancy is for personal, not commercial, use. Department of the Interior regulations (43 CFR 21) prohibit granting new leases for cabin site occupancy within Lake Mead. Under no action, existing conditions would continue. Extensions of leases up to five years would continue to be granted until the need for public use of the cabin site areas dictated termination. The determination of public need would be made two years in advance of the common expiration date.

Conclusion: Since the no-action alternative would mean a continuation of existing conditions, it would have no effect on the cabin site residents.

## IMPACT ON TRAILER VILLAGE RESIDENTS

Under the no-action alternative there would not be any changes from existing conditions. The following list presents the existing number of long-term, short-term, and RV sites at developed areas.

| Area | Existing Number of Sites Number of Sites (Long/Short/RV) |
|---|---|
| Katherine Landing | 104/34/0 |
| Cottonwood Cove | 223/75/0 |
| Fire Mountain | 0/0/0 |
| Willow Beach | 60/18/0 |
| Boulder Beach | 215/75/0 |
| Las Vegas Wash | 0/0/0 |
| Callville Bay | 94/6/0 |
| Boxcar Cove | 0/0/0 |
| Echo Bay | 69/58/0 |
| Overton Beach | 19/13/0 |
| Temple Bar | 103/13/0 |
| Totals | 883/297/0 |

Conclusion: The no-action alternative would not affect trailer village residents.

## IMPACT ON LEVEL OF CONCESSION OPERATIONS

Table 29 summarizes the existing level of services provided by the concessioner.

Conclusion: The level of concession services would not change under this alternative.

## IMPACT ON MINERAL LEASING OPPORTUNITY

The nonaction alternative would allow the continued consideration of mineral leasing in all management zones of the recreation area, outside those lands excepted by current regulation. Thus, 78 percent of the recreation area, or 1,162,550 acres, would be open to leasing consideration. Mineral development activity would be expected to continue according to past historical trends and would not be expected to change. Due to few known mineral resources within the recreation area, little activity would be expected. If the no-action alternative was selected, approximately 32,600 acres, or 2 percent of the recreation area, could potentially come under lease within the first year (approximately 30 prospecting permit applications totaling 11,640 acres are being held by the BLM pending completion of the planning documents for the NRA). Over half the acreage under application is in the Shivwits Plateau area, 5,840 acres are in the Gold Butte area, and the remaining 10,000 acres are scattered around the recreation area in smaller parcels. Because leasing is primarily speculative within the NRA, it is difficult to estimate how much of the leased land would be significantly disturbed by mineral development.

Excepted areas identified in 43 CFR are areas of the NRA where mineral leasing would not be considered. In these areas, lease or permit applications received are automatically denied. Approximately 1,162,550 acres (or 78 percent) of Lake Mead NRA are outside these excepted areas and are thus open to consideration of lease and prospecting permit applications. Stringent lease review procedures in these areas require evaluation of each lease application by the NRA for its potential impact on other resource values. In some instances, leases or permits might be denied in areas outside the established excepted areas. In other cases, leases or permits might be approved with protective stipulations to reduce or mitigate potential impacts. Stipulations might include no surface occupancy for all or part of the lease or permit acreage, or operations might be restricted to a particular season to protect wildlife migrations, reproduction areas, or wintering grounds.

Under the no-action alternative, the acreage open to leasing consideration would remain the same, and lease review procedures would be unchanged.

Conclusion: There would be no impact on mineral leasing opportunity under this alternative.

## IMPACT ON WILDERNESS LANDS

Under the no-action alternative, the recreation area would be managed according to the No-Action Management Zoning map (based on the existing

Table 29: Impact on Level of Concession Services, No-Action Alternative

| | Trailer Village Long-Term/ Short-term Sites | Motel Units | Restaurant Seats | Store Square Feet | Marina Slips/Moorings | Rental Boats # Houseboats/ # Other | Dry Boat Storage Spaces | Gas Station # Pumps | Gas Dock # Boat Capacity |
|---|---|---|---|---|---|---|---|---|---|
| Katherine Zone | | | | | | | | | |
| Katherine Landing | 104/33 | 52 | 117 | 3,600 | 764/0 | 75/41 | 210 | 2 | 14 |
| Lower Mohave East | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Cottonwood Zone | | | | | | | | | |
| Cottonwood Cove | 223/75 | 24 | 35 | 1,200 | 237/0 | 10/31 | 350 | 2 | 4 |
| Fire Mountain | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Willow Beach Zone | | | | | | | | | |
| Willow Beach | 60/18 | 24 | 100 | 1,000 | 182/16 | 0/40 | 120 | 1 | |
| Boulder Basin Zone | | | | | | | | | |
| Boulder Beach | 215/75 | 44 | 314 | 5,500 | 400/0 | 0/39 | 100 | 0 | |
| Las Vegas Wash | 0/0 | 0 | 36 | 3,300 | 595/3 | 0/35 | 100 | 0 | 3 |
| Callville Bay | 94/6 | 0 | 36 | 500 | 300/0 | 15/33 | 111 | 0 | |
| Boxcar Cove | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Echo Bay Zone | | | | | | | | | |
| Echo Bay | 69/58 | 52 | 120 | 9,000 | 314/0 | 70/18 | 97 | 4 | |
| Overton Beach Zone | | | | | | | | | |
| Overton Beach | 19/13 | 0 | 0 | 0 | 0/50 | 0/6 | 40 | 0 | 3 |
| Virgin/Temple Zone | | | | | | | | | |
| Temple Bar | 103/13 | 22 | 76 | 1,500 | 64/0 | 0/15 | 200 | 2 | |
| Totals--No-Action Alternative | 883/297 | 218 | 834 | 25,600 | 2,856/69 | 170/258 | 1,328 | 11 | 24 |

Land Management and Use map from the revised 1981 "Statement for Management") and the 1966 Excepted Areas map and regulations that define areas where mineral leasing would be considered on a case-by-case basis and where it is closed to (excepted from) leasing. There is virtually no relationship between these two schemes--the Excepted Areas map was never updated to reflect the more recent Land Management and Use map; the excepted areas are based on precise definitions and reflect general management intent. Accordingly, mineral leasing can be considered on a case-by-case basis in portions of most of the zones and subzones. The only areas of the NRA where leasing is categorically excluded (excepted) are those areas shown on the 1966 Excepted Areas map (NRA-LM 2291-A). These areas are

all lands within 200 feet of the centerline of any public road, or within 200 feet of any public utility including, but not limited to, electric transmission lines, pipelines, and railroads

all lands within the smallest legal subdivision of the public land surveys containing a spring or water hole, or within ¼ mile thereof on surveyed public land

all land within 300 feet of Lake Mead, Lake Mohave, or the Colorado River, measured horizontally from the shoreline at maximum water surface elevation, and all lands within the area of supervision of the Bureau of Reclamation around Hoover and Davis dams

all lands within any developed and/or concentrated public use area or other area of outstanding recreational significance as designated by the superintendent

Lease applications are considered within all other lands of the NRA, subject to a determination of effect upon surrounding park resources. Applications are reviewed through the NEPA process, which identifies significant resources. Those resources are then either excluded from the lease or stipulations are applied to mitigate the impact to them. Currently 1,162,550 acres of the NRA are open to consideration for mineral leasing.

Some adverse effect could occur to the visitor experience if existing leases were developed and pending permit applications in areas open to mineral leasing under this alternative were issued. However since it is unlikely that existing leases would result in any major new mining or oil and gas operation, the impact to visitor experience from sporadic exploration activity on these leases is expected to be minimal.

Although none of the NRA lands have been officially designated as wilderness, the Wilderness Criteria map in the "Affected Environment" section indicates those lands that meet or potentially meet the criteria of the Wilderness Act of 1964. The following units are keyed by number to that map and include most of the lands in the recreation area that possess primitive characteristics. Boundary lines of the units follow topographic features, access roads, the recreation area boundary line, section lines, and a line marking a 300-foot horizontal setback from the high waterlines of Lakes Mohave and Mead.

Units 1 and 2 center on the Newberry Mountains, which rise to an elevation of 5,600 feet and offer a cool refuge from the heat of the surrounding desert lowlands. Davis Dam, the Mohave power plant, Katherine Landing, and Bullhead City are developments visible from the southern and eastern portions of this unit. Of the 40,605 acres contained in these units, 22,940 acres in unit 2 are open to consideration for mineral leasing.

Unit 3, Nellis Wash, 15,870 acres, includes portions of the isolated Newberry Mountains along the western side of the recreation area. Fingerlike drainages and alluvial fans extend eastward from the mountains toward Lake Mohave. Some mining has occurred previously within the unit. All lands within this unit are open to consideration for mineral leasing.

Unit 4, Cottonwood Valley, potentially meets the criteria of the Wilderness Act because of outstanding mineral reservations. However, this gently sloping outwash provides solitude and isolation in a primitive setting just to the north of a major development at Katherine Landing. All of the 15,295 acres within this unit are open to consideration for mineral leasing.

Unit 5, the Black Mountains, capped by 2,000-foot Mount Davis, provides a scenic background to Lake Mohave. Scattered washes and side canyons transect the Black Mountains from east to west as they wend their way to the Colorado River. Of the 18,610 acres contained in this unit, 16,205 acres are open to consideration for mineral leasing.

Unit 6, Opal Mountain, contains a portion of the Eldorado Mountains, gently rolling hills, and outwashes extending to Lake Mohave. Rugged mountains, secluded valleys, and flat alluvial fans provide opportunities for seclusion in a setting of scenic splendor. Of the 17,635 acres contained in this unit, 16,180 acres are open to consideration for mineral leasing.

Units 7, 8, 10, 11, and 12, Fire Mountain and Black Canyon, contain some of the most spectacular and rugged terrain within the area. They consist of steep barren rocky crags, which begin at an elevation of 645 feet and terminate at an elevation of approximately 2,200 feet. These units combine to form the "Black Canyon" of Lake Mohave, which is noted for its hot springs and cool Colorado River. This area is a popular spot for visitors to see sharp and abrupt canyon walls and a myriad of geology. Units 11 and 12 only potentially meet the criteria of the act because the Bureau of Reclamation has identified these areas as potential locations for reclamation facilities ranging from Hoover Dam modifications to new transmission line corridors. Of the 70,470 acres within these units, 54,245 are open to consideration for mineral leasing.

Unit 9, Eldorado Mountain, contains approximately 29,665 acres of the picturesque and rugged Eldorado Mountains. The unit is a maze of peaks and side canyons with vertical cliffs extending to the edge of the Colorado River. All lands in this unit are open to consideration for mineral leasing.

Unit 13, Kingman Wash, contains approximately 40,835 acres. The undulating Black Mountains typify the topography of the region. Access to the unit is provided on all sides by existing road corridors. All lands are open to consideration for mineral leasing.

Unit 14, Bonelli Landing, comprises 13,875 acres of mainly alluvial fans and separates the hilly mountainous area of unit 13 from the gypsum beds of unit 21. This unit contains historic mining diggings and some archeological remains in the form of petroglyphs. Access to this unit is by the road to Bonelli Landing and Temple Bar. All lands are open to consideration for mineral leasing.

Units 15, 16, and 17, Pinto Valley, comprise approximately 38,340 acres of rugged hills and highly scenic valleys. These units contain Guardian Peak, which is one of the highest peaks in the area, and is used as a navigational aid. The northern side of Boulder Canyon is formed by these units, where steep cliffs or barren rock extend into the cool blue waters of Lake Mead in a dramatic fashion. Pinto Valley is a much-photographed topography, with the red sandstone outcroppings that merge with the green desert vegetation and the grays, browns, and yellows of the desert floor. A total of 22,730 acres in these units are open to consideration for mineral leasing.

Unit 18, Cathedral Wash, contains 18,820 acres. Mountainous terrain representing the northeast extremities of the Black Mountains dominates the area and contrasts with the flat surface of Lake Mead. All lands are open to consideration for mineral leasing.

Unit 19, Overton, 24,040 acres, consists of flat to "badland-like" lands lsoping westward from mountainous terrain to a road corridor east of the recreation area boundary. The unit forms the scenic background for lake users and for shoreline users on the west side of Overton Arm. These flat outwashes lack the spectacular contrasts found in other units and portray a typical desert landscape. This unit has retained its primitive characteristics and affords an opportunity for seclusion and an unconfined type of recreation. All lands are open to consideration for mineral leasing.

Unit 21--White Hills, unit 22--Temple Bar, and unit 23--Gregg's Hideout, all in the White Hills, offer isolation, scenic views, and historic attractions. This rolling hill country includes some evidence of earlier mining activities and trails. These activities did not scar the area excessively, and many scars have healed to the point of not being noticeable. Access to the area is possible by car on existing roads, by hiking from developed areas such as Temple Bar, or by boat from Lake Mead. These three units contain a total of approximately 52,130 acres, all of which are open to consideration for mineral leasing.

Units 20 and 24 to 32 are known as Twin Springs, Scanlon Wash, Hiller Mountains, Hell's Kitchen, Indian Hills, Cockscomb, Grand Wash Cliffs, Iceberg Ridge, South Cove, and Pearce Ferry. The units contain rugged mountain ranges that provide a scenic background for the Virgin Basin section of Lake Mead. Gently sloping outwash fans extend from the mountains to plunge abruptly into the reservoir. Of the 135,688 acres

within these units, 116,450 acres are open to consideration for mineral leasing.

Unit 33, Shivwits Plateau, contains approximately 83,980 acres. Diverse activities occur in this remote section of Lake Mead, ranging from hunting to grazing. Due to a higher altitude, the region is cooler, has more precipitation, and supports pinyon/juniper and ponderosa pine forests and a wider variety of wildlife than can be found in the rest of the recreation area. Kelly Point, Twin Point, and other points along the rim permit spectacular views of the Grand Canyon. Because most of the land within this unit is subject to mineral reservations, the unit only potentially meets the criteria of the Wilderness Act. Several of the units might appear to be narrow and splintered by access roads. However, when considered with the adjacent proposed wilderness in Grand Canyon, it is apparent that these would form a significant continguous wilderness unit. All lands in this unit are open to consideration for mineral leasing.

Should this alternative be selected, the remote undeveloped nature of the Shivwits area could be dramatically altered by potential uranium mining. Because of its unique juxtaposition with Grand Canyon National Park, this area of the NRA provides a scenic, remote and primitive landscape which blends well with the lower Grand Canyon area. Activities such as river float trips, scenic overflights and backcountry use actually focus on the Grand Canyon "nature" of this country, crossing between the national park and national recreation lands without recognition of the "difference." Inherent to the visitor experience on the Shivwits Plateau is its remoteness and undeveloped nature where unconfined recreational activities can take place.

Mine facilities and operations would create a man-made disturbance out-of-character with the remote, primitive, existing nature of the area. The presence of mining equipment, improved roads, structures, spoil and ore stockpiles would be a sharp, and in some cases irreversible, contrast to the present landscpae. Should mining actually take place, significant impact to the visitor experience is expected to occur not only to visitors of the NRA, but also to many of the visitors of the lower Grand Canyon country within Grand Canyon National Park.

Unit 34--Andrus Point, unit 35--Whitmore Point, and unit 36--Lava consist of approximately 58,430 acres in the northeast sector of the recreation area. Contained within these units are Parashant, Andrus, and Whitmore canyons; all are precipitous side canyons of significant grandeur that drain into the Grand Canyon. The entire area is undeveloped land retaining its primeval character, and it provides an opportunity for solitude or a primitive and unconfined type of recreation in a scenic setting of steep escarpments, colorful red walls, and deep canyons. Geologic formations and processes in evidence here may provide information on the origin of the Grand Canyon. Archeological sites of several Indian cultures, including the Virgin Anasazi and more recently the Paiutes, are also found here. Adjacent primitive areas of Grand Canyon National Park provide for a contiguous unit of primitive lands

extending westward from the Pine Mountains across the Sanup and Shivwits plateaus to the Grand Wash Cliffs. All of the lands within these three units are open to consideration for mineral leasing.

See table 30 for summary of wilderness acres affected.

Conclusion: The 1,245,275 acres of the NRA that are open to consideration for mineral leasing could affect 488,220 acres, or 89 percent, of those lands that meet the criteria of the Wilderness Act and 113,550 acres, or 88 percent, of those lands which potentially meet the criteria. Mining activities as a result of mineral leasing in these areas could unnaturally scar the landscape and alter the wilderness character of these lands, making wilderness values on at least part of these lands lost to any future possible designation.

Table 30: Summary of the Effects of No-Action Alternative on Wilderness Lands

| | Acres Meeting or Potentially Meeting the Wilderness Act Criteria | | Acres Affected | |
|---|---|---|---|---|
| | Wilderness | Potential Wilderness Area | Wilderness | Potential Wilderness Area |
| 1 | 7,650 | 0 | 0 | 0 |
| 2 | 32,955 | 0 | 22,940 | 0 |
| 3 | 15,870 | 0 | 15,870 | 0 |
| 4 | 0 | 15,295 | 0 | 15,295 |
| 5 | 17,970 | 640 | 15,565 | 640 |
| 6 | 17,635 | 0 | 16,180 | 0 |
| 7 | 15,145 | 0 | 15,145 | 0 |
| 8 | 25,605 | 0 | 25,605 | 0 |
| 9 | 29,665 | 0 | 29,665 | 0 |
| 10 | 2,045 | 0 | 1,000 | 0 |
| 11 | 0 | 14,645 | 0 | 5,325 |
| 12 | 0 | 13,030 | 0 | 7,170 |
| 13 | 40,835 | | 40,835 | 0 |
| 14 | 13,875 | | 13,875 | 0 |
| 15 | 17,115 | | 12,085 | 0 |
| 16 | 6,680 | | 2,865 | 0 |
| 17 | 14,545 | | 7,780 | 0 |
| 18 | 18,820 | | 18,820 | 0 |
| 19 | 24,040 | | 24,040 | 0 |
| 20 | 10,610 | | 10,610 | 0 |
| 21 | 25,580 | | 25,580 | 0 |
| 22 | 16,665 | | 16,665 | 0 |
| 23 | 9,885 | 80 | 9,885 | 80 |
| 24 | 22,095 | | 22,095 | 0 |
| 25 | 8,545 | | 8,545 | 0 |
| 26 | 14,620 | | 14,620 | 0 |
| 27 | 7,720 | | 0 | 0 |
| 28 | 14,020 | | 12,900 | 0 |
| 29 | 13,895 | | 6,965 | 0 |
| 30 | 15,143 | 460 | 11,675 | 460 |
| 31 | 16,480 | | 16,480 | 0 |
| 32 | 12,100 | | 12,100 | 0 |
| 33 | 0 | 83,980 | 0 | 83,980 |
| 34 | 14,905 | 0 | 14,905 | 0 |
| 35 | 32,215 | 0 | 32,215 | 0 |
| 36 | 10,710 | 600 | 10,710 | 600 |
| Totals | 545,645 | 128,730 | 488,220 | 113,550 |
| Percentage | 100 | 100 | 89 | 88 |

## ENVIRONMENTAL IMPACTS OF ALTERNATIVE A

A summary of the following impacts is presented in the "Summary" section at the beginning of this document.

### IMPACT ON PUBLIC SAFETY IN FLOODPLAINS

Many areas in the recreation area are subject to flash flooding. The 100-year flood has a 1 percent chance of occurring in any year. The probable maximum flood is the greatest flood that could ever be expected. Probable maximum floods do occur, but the frequency is uncertain; the likelihood in any year is less than 1/10 of 1 percent. Flooding is most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor use facilities are out of the floodplain. At Boulder Beach all development is on a broad alluvial fan, with protection provided by earth dikes. Also, because flooding at Boulder Beach takes the form of sheet flows up to 2 feet in depth, it is not considered to present as great a danger to human life or property as the concentrated flows in canyons at other areas of the NRA; therefore, no potential victims or damage to structures will be shown for Boulder Beach in the impact sections relating to floodplains. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain. See the discussion of floodplains and wetlands in the "Affected Environment" section of this document for a more detailed explanation. The development concept plan graphics for each developed area show the extents of the 100-year and probable maximum floods.

Alternative A would mitigate the flood hazard up to the level of the probable maximum flood by building major structures like dams or channels and by relocating some developments. Removal of structures from the floodplain provides the best protection from floods. Structural measures offer the next best method. Warning systems provide less protection than either of the preceding methods.

The following is a summary of the flood mitigation proposals for each zone of the recreation area. All areas with flood hazard would have warning systems installed even if they were structurally protected.

Katherine Landing. The development would be protected to the level of the probable maximum flood through structural measures such as diversion canals and diversion dikes.

Cottonwood Cove. NPS housing and maintenance areas would be relocated out of the probable maximum floodplain. Other development in the area would be protected to the level of the probable maximum flood through structural measures such as dikes and channels.

Willow Beach. The launch ramp, restaurant, store, campground (at ¼ to ½ its original capacity), ranger station, NPS housing, NPS maintenance facilities, trailer village, concession housing, and concession maintenance facilities would be relocated out of the

probable maximum floodplain. The motel and a portion of the parking area would be protected from the probable maximum flood with a 6-foot-high wall. A riprap dike would protect the sewage lagoons from the 100-year flood.

Boulder Beach. The earth dikes in the Boulder Beach area would be regraded and reinforced with gabions to protect the area to the probable maximum flood level.

Las Vegas Wash. The concession dry boat storage and concession maintenance area would be relocated out of the probable maximum floodplain. No structural measures or warning system would be used at Las Vegas Wash.

Overton Beach. The campground would be relocated out of the floodplain.

Temple Bar. Diversion dikes and channels would be added to accommodate the probable maximum flood.

A complete discussion of actions that would be taken to protect the flood-hazard areas from the effects of the probable maximum flood is found in the "Alternative Development Concept Actions" section under alternative A.

An estimated 135 people would be in the probable maximum floodplain during the day and none would be there at night. This represents approximately 0.1 percent of the people expected to be in the recreation area on a summer weekend day (96,000) and is 97 percent fewer people during the day and 100 percent fewer people at night than would be expected under existing conditions.

Compared with existing conditions, approximately 1,045 additional people would be protected from the probable maximum flood at Katherine by structural measures. The dry boat storage would receive no protection from the probable maximum flood, but fewer than five people would be expected there at any one time.

Relocation of NPS housing and NPS maintenance facilities out of the floodplain at Cottonwood would protect approximately 15 daytime occupants of the probable maximum floodplain. The additional 1,720 projected summer weekend daytime occupants of the probable maximum floodplain at Cottonwood would be protected from the probable maximum flood by structural measures.

At Willow Beach, relocation of the launch ramp, restaurant, store, campground (at ¼ to ½ its original capacity), ranger station, NPS housing, NPS maintenance facilities, trailer village, concession housing, and concession maintenance facilities out of the probable maximum floodplain would mean that approximately 376 fewer people would be expected to be in the probable maximum floodplain on an average summer weekend day than under existing conditions. Protection of the motel and a portion of the parking area from the probable maximum flood with a 6-foot-high wall would provide additional safety to 70 expected occupants

of the probable maximum floodplain. Approximately 50 people would be expected to be in the probable maximum floodplain after the above measures were in place because the only protection for the access roads, dry boat storage, and canoe/raft takeout would be the existing warning system.

The expansion of the campground and trailer village at Boulder Beach would mean that an additional 112 people would be at risk in the probable maximum floodplain as compared with existing conditions. The expected 1,371 people (which includes the additional 112 people) in the probable maximum floodplain would be protected by structural measures and a warning system.

The same situation as existing conditions would occur at Las Vegas Wash, with only the launch ramp in the floodplain. About 40 people could be expected in the launch ramp area during the day. The hazard would be mitigated by a warning system.

The campground at Overton Beach would be relocated, leaving only the swim beach in the floodplain. This situation would leave about 40 people in the floodplain during the day; the hazard would be mitigated by a warning system.

All probable maximum floodplain occupants would be protected by dikes and channels at Temple Bar.

Conclusion: This alternative would provide the greatest level of protection of any alternative. After all flood mitigation actions were taken, about 135 people in the daytime would remain in the probable maximum floodplain where the hazard would be mitigated only by warning systems. That is a 97 percent reduction compared to existing conditions. At night no people would be in the areas only protected by warning systems. All other people in the probable maximum floodplain (day or night) would be protected by structures like dikes and channels. About 135 people during the day and none at night would remain in the 100-year floodplain protected only by a warning system. That represents an 89 percent and 100 percent reduction respectively compared to existing conditions.

## IMPACT ON PROPERTY IN FLOODPLAINS

Many areas in the recreation area are subject to flash flooding. Flooding is the most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor facilities are out of the floodplain. At Boulder Beach, all development is on a broad alluvial fan, with protection provided by earth dikes. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain. A more thorough discussion of floodplains may be found in the "Affected Environment" section of this document. The development concept plan graphics for each developed area shows the extent of the 100-year and probable maximum floods.

Table 20 shows development in the floodplain under each alternative including no action. Alternative A would mitigate the flood hazard up to the level of the probable maximum flood by building major structures like dikes or channels and relocating some developments. However, the property shown in the flood-hazard zone under alternative A would remain susceptible to flood damage or destruction in the event of a flood. The cost of replacing structures left unprotected in the 100-year floodplain would be approximately $1 million; and for replacing those in the probable maximum floodplain, approximately $1.1 million. These costs would not cover utilities, furnishings, equipment, vehicles, flood-control devices, debris removal, search and rescue, or expenses of victims. The cost to replace facilities damaged by the 100-year flood would be approximately 15 percent of the cost of replacing structures in the 100-year floodplain under existing conditions. The cost to replace structures damaged by the probable maximum flood would be about 5 percent of the cost of replacing structures in the same floodplain under existing conditions.

Conclusion: This is the most effective alternative in terms of protecting structures from flood damage.

## IMPACT ON RESERVOIR WATER QUALITY

These impacts would be the same as for the proposed action.

## IMPACT ON DESERT SPRING ECOLOGICAL COMMUNITIES

These impacts would be the same as for the proposed action.

## IMPACT ON SOILS

Soils of the area are extremely variable. Climate, vegetation, parent material, elevation, slope, and aspect affect the development of these soils, which are characterized by a wide range of physical and chemical properties. Texture, permeability, depth, stoniness, organic content, alkalinity, and other properties are highly diverse and change quickly within short distances.

Alternative A would maintain existing areas for visitor use. No new major access points or developments would be constructed along the reservoir shores. The passive offroad vehicle recommendations of the proposed action would be implemented, some lakeside roadways would be eliminated, and accesses to the lakeshore would be reduced. The reduction in lake accesses would encourage offroad drivers to trailbreak their own roads, and the rate of soil damage would increase from its present level of 30 to 40 acres per year. Research on the rehabilitation of offroad vehicle soil damage and implementation of a rehabilitation program would be done as in the proposed action, but this would probably be a losing battle because soils can be damaged at a much faster rate than they can be rehabilitated.

The construction of roadways and expansion of existing facilities under this alternative would destroy or severely damage about 178 acres of undisturbed soils. Rehabilitation and landscaping would be done around construction sites but natural ecosystems and soil productivity would not be restored. The roadway construction and flood protection measures in this alternative would require about 280,000 cubic yards of material to be removed from cuts and about 500,000 cubic yards of material to be deposited as fill. The deficit of 220,000 cubic yards of fill would have to be imported from existing quarries or obtained from flood-control excavations in the developed areas. This is only 30,000 cubic yards less than the proposed action.

The intent of this alternative is the same as that of the proposed action in that mineral leasing would be restricted to the resource utilization subzone. The difference between the proposed action and alternative A is in the amount of acreage contained in the resource utilization zone. Under this alternative only 51,550 acres would remain open to mineral leasing consideration to achieve the objective of resource protection and reduced consumptive uses. This alternative would also reduce the amount of land where current prospecting permit applications have been filed from the 11,640 acres available under the proposed action to 940 acres under alternative A. Existing leases, mining claims, and private mineral rights would be unaffected. Under this alternative, up to 19,500 acres of the NRA could be subject to mineral development on 18,487 acres of existing leases and 940 acres of pending prospecting permits (if approved), a reduction of 10,500 acres from the proposed action.

Exploration activities associated with prospecting permits and oil and gas leases could result in damage to soils through excavation and erosion, with additional losses expected from associated excavation and removal for road construction and similar earthwork. Soil nutrients that have developed over long periods of time would be reduced in these disturbed soils by exposure to erosion and accelerated weathering; soil compaction and abnormally high soil temperatures could also occur. The reclamation potential of the disturbed areas would be reduced unless proper care was taken to mitigate soil loss. Because of the diversity of soils in the recreation area, site-specific soils data would be necessary for detailed impact assessment and reclamation planning before mining approval.

Mineral leasing would not be expected to significantly affect soils in any area of the park. Some damage or loss could be expected from sporadic exploration activities; however, the amount of acreage affected would likely be less than 300 acres over the next 10 years if the present mineral development trends continued in the area.

Conclusion: Under alternative A, the rate of damage and erosion from offroad vehicles would increase and only be partially offset by rehabilitation efforts. Developments would destroy or severely damage about 178 acres of lithosols and red desert soils and cause minor disruptions in drainage patterns, which would temporarily increase erosion potential. Loss or damage to recreation area soils resulting from mineral leasing would not be significant over the next decade, assuming current mineral development activity followed historical trends.

## IMPACT ON SIGNIFICANT NATURAL FEATURES

These impacts would be the same as for the proposed action.

## IMPACT ON THREATENED OR ENDANGERED SPECIES

The endangered bonytail chub, Gila elegans, and the threatened bald eagle, Haliaeetus leucocephalus, are the only two federally listed animal species that are known to occur within the NRA. There are no threatened or endangered plant species, proposed species, or critical habitats in Lake Mead. There are several federal candidate plant and animal spieces that do, or could, inhabit or visit the recreation area. Some of these species are also listed by the states of Arizona and Nevada as threatened or endangered species or species of concern. Table 18 identifies the status and legal classification of all these threatened, endangered, or other rare species. Of the 20 species, 18 are known in the recreation area. Of the 18, six are rare migratory transients with wide distributions outside the area. Thus, only 12 are of primary concern.

The intent of this alternative is the same as that of the proposed action in that mineral leasing would be restricted to the resource utilization subzone. The difference between the proposed action and alternative A is in the amount of acreage contained in the resource utilization zone. Under this alternative only 51,550 acres would remain open to mineral leasing consideration to achieve the objective of resource protection and reduced consumptive uses. This alternative would also reduce the amount of land where current prospecting permit applications have been filed from the 11,640 acres available under the proposed action to 940 acres under alternative A. Existing leases, mining claims, and private mineral rights would be unaffected. Under this alternative, up to 19,500 acres of the NRA could be subject to mineral development on 18,487 acres of existing leases and 940 acres of pending prospecting permits (if approved), a reduction of 10,500 acres from the proposed action.

Under this alternative 1,148,100 acres or 77 percent of the NRA would be placed in the natural zone. Known habitat or potential habitat for rare, threatened, or endangered plant and animal species would be further protected by placement in the environmental protection or outstanding natural feature subzones of the natural zone. Areas open to mineral leasing would be the 51,550 acres in the resource utilization subzone and an additional 19,500 acres of existing leases and pending prospecting permits. No new developments are proposed under this alternative.

About 19,500 acres would have the highest potential for mineral development--18,487 acres of existing leases and 940 acres of pending prospecting permits (if approved). None of the leases and pending permits would be in areas where they could potentially affect any threatened or endangered animal species. Two existing leases and one pending prospecting permit would be located within 5 miles of known locations of candidate threatened or endangered plant species. Additional surveys on these leases or permits could reveal additional populations of these plants. Potential threats to these plants would include physical

destruction of populations or habitat and illegal collection. When specific mineral development proposals were received in these areas, surveys would be conducted and protective stipulations applied to the plan of operation, but it would not be certain that all potential effects would be avoided.

Conclusion: Impacts on threatened or endangered species resulting from this alternative could occur but are now likely to be insignificant.

## IMPACT ON VEGETATION

Approximately 71 percent of the NRA is dominated by the creosotebush community. This community type is widespread throughout the desert southwest and is the representative low elevation vegetation type in the Mojave and Sonoran deserts. Vegetation typical of higher elevations includes blackbrush, sagebrush, and pinyon/juniper. These vegetation types are common throughout the intermountain region.

Precipitation rates in low elevation communities are generally less than 5 inches annually, while higher elevations receive 5 to 15 inches. Because of these low precipitation rates, revegetation rates on disturbed sites might be as much as 50 to 75 years.

The intent of this alternative is the same as that of the proposed action in that mineral leasing would be restricted to the resource utilization subzone. The difference between the proposed action and alternative A is in the amount of acreage contained in the resource utilization zone. Under this alternative only 51,550 acres would remain open to mineral leasing consideration in order to achieve the objective of resource protection and reduced consumptive uses. This alternative would also reduce the amount of land where current prospecting permit applications have been filed from the 11,640 acres available under the proposed action to 940 acres under alternative A. Existing leases, mining claims, and private mineral rights would be unaffected. Up to 19,500 acres of the NRA could be subjected to mineral development on 18,487 acres of existing leases and 940 acres of pending prospecting permits (if approved).

Impacts to vegetation under this alternative would be greatest if an ore deposit was discovered and production of a mine initiated. Several hundred acres of vegetation could potentially be destroyed through development of mine surface facilities, access roads, and tailings piles. However, given the history of Lake Mead leasing, this level of development is unlikely. Exploration activities on mineral and oil and gas leases would disturb only a small amount of native vegetation.

Conclusion: None of the impacts to vegetation under this alternative would be significant.

## IMPACT ON DESERT BIGHORN SHEEP

Under this alternative, no desert bighorn habitat would be available for mineral leasing; therefore, no impacts from pending prospecting permits

would be expected. However, existing oil and gas leases in the Pinto Valley, totaling 10,886 acres, are located in an area of bighorn sheep habitat. If current owners of these leases pursued exploration activities in this area, impacts to desert bighorn could be expected. Seismic exploration could cause increased stress in the herd due to increased human presence and noise from blasting and vehicle travel. Continued stress in bighorn populations elsewhere has led to population die-offs because of increased susceptibility to disease organisms. Careful alignment of seismic lines, placement of remote recorders by hiking into sites, and timing of operations should reduce this threat.

To mitigate impacts to bighorn sheep populations if mineral leases have active mineral operations taking place on them, a quarterly population and distribution survey would be conducted on those leases and the adjacent lands inhabited by the bighorn. A program to collect and record the data needed for this type of survey is being developed by the Cooperative National Park Resources Studies Unit, University of Nevada, Las Vegas. This program will gather baseline population data and annual herd movements for all sheep populations near mineral leases, so that any changes from the normal patterns can be easily identified.

All operations that would occur within known lambing areas would contain a stipulation preventing operations from taking place during the lambing period (normally late in December to early April). If significant detrimental impacts to a bighorn population from exploration or mining operations were found, a temporary shutdown of operation would be made until corrective actions could be made to prevent further detriment to the herd.

Conclusion: If exploration activities remained sporadic, as in the past, impacts to the sheep population should not be significant enough to affect overall population health.

## IMPACT ON VISITOR CROWDING/CONGESTION

Existing conditions at the developed areas are extremely crowded and congested on weekends during the summer. Holiday weekends are the worst. Memorial Day weekend has had visitation of 254,000. Annual visitation is around 6.5 million and expected to increase to around 9 million by the year 2000. Currently it is not unusual for visitors at several of the larger developed areas to wait up to an hour to launch their boats, and twice that long on a holiday weekend. Several of the popular campgrounds and motels are full during the summer. At several developed areas confusing circulation systems frustrate first-time visitors from easily finding their way around. Illegal parking along road shoulders is a common problem that results when existing parking areas fill.

Alternative A would accommodate increasing visitor use and solve existing crowding/congestion problems by expanding and improving existing developed areas. (For a full discussion of these actions, refer to the "Alternative Development Concept Actions" section.) These actions would include many proposals intended to accommodate increasing visitation or to

solve crowding/congestion. To understand the magnitude of these proposals, the increases in parking, overnight accommodations, and launch ramps are used as examples. Alternative A includes an increase of 5,990 parking spaces (19,660 spaces exist) or an increase of 30 percent. There are 1,755 overnight accommodation units (a unit is one campsite, one motel room, or one RV site). Alternative A would increase them by 1,110 units or an increase of 63 percent. There are 73 launch ramp lanes, and alternative A would add 10, an increase of 14 percent.

Over the life of the plan visitation is expected to increase by about 68 percent, and most visitor facility proposals under alternative A call for increases from 30 to 63 percent beyond existing levels. This parity between expected use and proposed facility levels indicates that crowding/congestion would not get any worse than it is now; however, it should be less than current levels. For example, circulation improvements would facilitate vehicle and pedestrian movements in several developed areas.

Conclusion: The proposed facility improvements and expansion would reduce crowding/congestion by an unknown amount compared to existing levels, while accommodating increasing numbers of visitors.

## IMPACT ON VACATION CABIN SITE RESIDENTS

Lake Mead NRA has three lakefront areas in which sites may be leased for privately owned vacation cabins. These areas are Katherine Landing, which has 39 cabin sites, Stewarts Point, which has 60 cabin sites, and Temple Bar, which has 36 cabin sites. Cabin site occupancy is for personal, not commercial, use. Department of the Interior regulations (43 CFR 21) prohibit granting new leases for cabin site occupancy within Lake Mead. Under alternative A, to provide for increased use in existing developed areas, the cabin site areas at Katherine Landing and Temple Bar would be removed and replaced with visitor facilities; the cabin sites at Stewarts Point would be retained.

At Katherine Landing all 39 cabins would be removed and replaced with public facilities, including a 40-table picnic area, 25-site RV trailer park, 24-unit motel, four-lane launch ramp, and 300 parking spaces. At Temple Bar all 36 cabins would be removed and replaced with public facilities, including a picnic area, swim beach, and 80 recreation vehicle sites. The social impact resulting from removal of these 75 cabin sites would be most felt by the residents that would no longer be able to live or vacation close to the lake. These people would have to relocate to other areas within the recreation area or to communities outside the area. This would be a traumatic event to many of these occupants, who have spent as many as 30 years in their cabins. Throughout the years, many have invested their time, energy, and creativity in landscaping and home improvements that they hoped to enjoy for the rest of their lives. There could be some economic impact to some of the occupants because the government is not required to relocate renters and lessees.

Conclusion: Under alternative A, proposals for removal of the cabin site areas and replacement with public facilities at Katherine Landing and

Temple Bar would eliminate 75 vacation cabin sites. Vacation cabin sites at Stewarts Point would not be affected.

## IMPACT ON TRAILER VILLAGE RESIDENTS

The general concept for trailer villages under alternative A would be the same as for the proposed action. The number of long-term, short-term, and RV sites available at each developed area and the proposed actions under alternative A are presented below.

| Area | Existing Number of Sites (Long/Short/RV) | Alternative A Actions |
|---|---|---|
| Katherine Landing | 104/34/0 | Retain existing sites |
| Cottonwood Cove | 223/75/0 | Retain existing sites |
| Fire Mountain | 0/0/0 | Same as no action |
| Willow Beach | 60/18/0 | Relocate 50 long-term and 18 short-term sites |
| Boulder Beach | 215/75/0 | Add 75 short-term sites |
| Las Vegas Wash | 0/0/0 | Add 80 RV sites |
| Callville Bay | 94/6/0 | Retain existing sites |
| Boxcar Cove | 0/0/0 | Same as no action |
| Echo Bay | 69/58/0 | Add 42 RV sites |
| Overton Beach | 19/13/0 | Relocate/convert to 15 long-term/30 RV sites |
| Temple Bar | 103/13/0 | Remove 10 long-term and 7 short-term sites |
| Total | 887/297 | |

As under the proposed action, adding RV sites at most of the developed areas would have no affect on existing trailer village residents. The effects of converting long-term sites to short-term sites would be mitigated by converting them as current residents vacated the sites. Under alternative A trailer village residents would be most affected in the following areas: Willow Beach, where 50 of the 60 long-term and all 18 short-term residents would be relocated out of the flood-hazard zone to a safer area; Overton Beach, where 15 long-term and 13 short-term residents would be relocated and four long-term sites could be removed; and Temple Bar where 10 long-term and seven short-term residents would be removed to provide for a high-water parking area.

The social impact resulting from these trailer village relocations would be felt most by the four long-term residents at Overton Beach and 10 long-term residents at Temple Bar. These people would have to relocate to other areas within the recreation area or to communities outside the area. This would be a traumatic event to many of these occupants who have spent as many as 30 years in their trailers. Throughout the years, many have invested their time, energy, and creativity in landscaping and home improvements that they hoped to enjoy for the rest of their lives.

There could be some economic impact to some of the occupants because the government is not required to relocate renters and lessees. Those impacts would be mostly mitigated, because where long-term trailer residents must be reduced in number, they would be reduced through attrition before any action would be taken to force residents out of their trailer spaces.

Conclusion: Proposed actions to add RV sites or convert long-term sites to short-term sites would have little or no effect on existing trailer village residents at most developed areas. Trailer village residents affected by the proposal would be those at Willow Beach, where long-term and short-term occupants would be relocated to a safer areas, and those at Overton Beach and Temple Bar. At Overton Beach four long-term sites would be removed, and at Temple Bar 10 long-term sites would be converted to high-water parking. To mitigate the effect on these long-term residents, they would first be reduced by attrition. However, some long-term residents would have to relocate to another developed area or outside the recreation area. The number of long-term sites adversely affected at these areas are 14 out of 887 for the entire NRA, or 2 percent of the total long-term sites. Only 7 of the 297 short-term sites (or 2 percent) would be affected.

## IMPACT ON LEVEL OF CONCESSION OPERATIONS

Table 31 summarizes the level of services to be provided by the concessioner under alternative A.

Conclusion: There would be an increase in the level of concession services over existing conditions in eight of the nine categories. This increase would range from 21 percent for gas docks to 146 percent for motel units. In one of the nine categories--long-term trailer village spaces--there would be a 2 percent decrease.

## IMPACT ON MINERAL LEASING OPPORTUNITY

Under this alternative, 51,550 acres of the NRA would remain open to consideration for mineral leasing (the size of the resource utilization subzone would be 81,600 acres smaller than under the proposed action). Most of the lands removed from leasing consideration would be south of Temple Bar and west of the main body of Lake Mohave. None of these lands have experienced significant mineral development activity, and no known mineral resources exist.

The intent of this alternative is the same as that of the proposed action in that mineral leasing would be restricted to the resource utilization subzone. The difference between the proposed action and alternative A is in the amount of acreage contained in the resource utilization subzone. Under this alternative only 51,550 acres would remain open to mineral leasing consideration to achieve the objective of resource protection and reduced consumptive uses. This alternative would also reduce the amount of land where current prospecting permit applications have been filed from the 11,640 acres available under the proposed action to 940 acres

Table 31: Impact on Level of Concession Services, Alternative A

| | Trailer Village Long-Term/ Short-term Sites | Motel Units | Restaurant Seats | Store Square Feet | Marina Slips/Moorings | Rental Boats # Houseboats/ # Other | Dry Boat Storage Spaces | Gas Station # Pumps | Gas Dock # Boat Capacity |
|---|---|---|---|---|---|---|---|---|---|
| Katherine Zone | | | | | | | | | |
| Katherine Landing | 104/39 | 104 | 234 | 7,200 | 805/0 | 75/41 | 420 | 2 | 14 |
| Lower Mohave East | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Cottonwood Zone | | | | | | | | | |
| Cottonwood Cove | 223/75 | 48 | 70 | 2,400 | 535/0 | 25/31 | 465 | 2 | 8 |
| Fire Mountain | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Willow Beach Zone | | | | | | | | | |
| Willow Beach | 60/18 | 24 | 100 | 1,000 | 270/16 | 0/40 | 120 | 1 | |
| Boulder Basin Zone | | | | | | | | | |
| Boulder Beach | 215/150 | 88 | 314 | 11,000 | 875/0 | 0/78 | 275 | 0 | |
| Las Vegas Wash | 0/80 | 50 | 54 | 3,300 | 630/3 | 0/70 | 200 | 0 | 4 |
| Callville Bay | 94/6 | 30 | 60 | 1,000 | 1,045/0 | 15/33 | 166 | 2 | |
| Boxcar Cove | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Echo Bay Zone | | | | | | | | | |
| Echo Bay | 69/100 | 104 | 200 | 9,000 | 530/0 | 90/25 | 200 | 4 | |
| Overton Beach Zone | | | | | | | | | |
| Overton Beach | 15/30 | 0 | 100 | 1,000 | 0/140 | 0/12 | 80 | 2 | 3 |
| Virgin/Temple Zone | | | | | | | | | |
| Temple Bar | 93/6 | 88 | 226 | 3,500 | 980/0 | 45/15 | 300 | 2 | |
| Totals: Alternative A | 873/504 | 536 | 1,358 | 39,400 | 5,670/159 | 250/345 | 2,226 | 15 | 29 |
| Existing Conditions | 887/297 | 218 | 834 | 25,600 | 3,317/99 | 170/258 | 1,328 | 11 | 24 |
| Net change | -14/+208 | +318 | +524 | +13,800 | +2,353/+60 | +80/+87 | +898 | +4 | +5 |
| Percent change | -2/+70 | +146 | +63 | +54 | +71/+61 | +47/+34 | +68 | +36 | +21 |

under alternative A. Existing leases, mining claims, and private mineral rights would be unaffected. Up to 19,500 acres of the NRA could be subject to mineral development on 18,487 acres of existing leases and 940 acres of pending prospecting permits (if approved).

Mineral development could still take place on the 18,487 acres covered by existing leases within the NRA. However, of the 32,600 acres of land already applied for prospecting permits, only 940 acres would remain available for exploration. The remaining 31,640 acres would be withdrawn from further mineral leasing consideration. Most of the pending applications that would be affected by this withdrawal are for gold and silver prospecting in the Gold Butte and Malpais Mesa areas of the NRA.

The primary impacts of this alternative on mineral leasing opportunities would be identical to the impacts described under the proposed action--the Shivwits Plateau zone would remain unavailable for further mineral leasing consideration. For a discussion of these impacts on uranium development, see the proposed action.

Removal of additional lands from the resource utilization subzone under this alternative would affect an additional five applicants who currently await action on prospecting permit applications. The lost opportunity for exploration on these lands would mean that geological knowledge regarding the nature, extent, and formation of any mineralized zones would not be gained. However, since over 100 years of prospecting and exploration have never resulted in a significant discovery of these precious metals within the NRA, it is extremely improbable that significant gold or silver resources would be found on those lands excluded from leasing. In light of the highly speculative nature of the mineral resources within the NRA, it appears that the long-term gains obtained from preserving the recreational values of the park far outweigh the uncertain, relatively short-term economic gains from mineral development in these areas of the NRA.

Conclusion: This alternative would not have a significant effect on the opportunity to develop a mineral resource.

## IMPACT ON WILDERNESS LANDS

The objective of management zoning under alternative A would be maximum protection of natural resources. The only difference between this alternative and the proposed action is that the resource utilization subzone of the special use zone would be smaller because all areas meeting the Wilderness Act criteria would be excluded from mineral leasing. All areas possessing wilderness values would be in the natural zone, which emphasizes preservation and protection of natural resources.

Although no lands are proposed for wilderness designation, the Wilderness Suitability map in the "Affected Environment" section indicates those lands that meet or potentially meet the criteria of the Wilderness Act of 1964. None of these lands would be affected under this alternative.

## ENVIRONMENTAL IMPACTS OF ALTERNATIVE B

A summary of the following impacts is presented in the "Summary" section at the beginning of this document.

### IMPACT ON PUBLIC SAFETY IN FLOODPLAINS

Many areas in the recreation area are subject to flash flooding. The 100-year flood has a 1 percent chance of ocurring in any year. The probable maximum flood is the greatest flood that could ever be expected. Probable maximum floods do occur, but the frequency is uncertain; the likelihood in any year is less than 1/10 of 1 percent. Flooding is most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor facilities are out of the floodplain. At Boulder Beach all development is on a broad alluvial fan, with protection provided by earth dikes. Also, because flooding at Boulder Beach takes the form of sheet flows up to 2 feet in depth, it is not considered to present as great a danger to human life or property as the concentrated flows in canyons at other areas of the NRA; therefore, no potential victims or damage to structures are shown for Boulder Beach in the impact sections relating to floodplains. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain. See the discussion of floodplains and wetlands in the "Affected Environment" section for a more detailed explanation. The DCP graphics for each developed area show the extent of the 100-year and probable maximum floods.

Alternative B would mitigate the flood hazard up to the level of the probable maximum flood primarily through nonstructural measures. These include relocation of facilities out of the floodplains and installation of warning systems. Removal of structures from the floodplains would provide the best protection, structural measures would offer the next best method. Warning systems would provide less protection than either of the preceding methods.

The following is a summary of the flood mitigation proposals for each zone of the recreation area under alternative B. All areas with flood hazards would have warning systems installed even if they were structurally protected.

Katherine Landing. The NPS maintenance area and 15 long-term and all 33 short-term trailer sites would be relocated out of the probable maximum floodplain. Use of North and South Telephone Cove as a primitive use area would be prohibited. The remaining development with the exception of the dry boat storage would be protected to the level of the probable maximum flood through structural measures such as diversion canals and diversion dikes.

Cottonwood Cove. The National Park Service would buy out the concessioner, remove the concession facilities, and operate the area as a day use access point to Lake Mohave.

Willow Beach. The National Park Service would buy out the concessioner and operate the area as a day use access point, with some facilities being relocated and operated at reduced capacity. Such facilities include parking, ranger station, NPS housing and maintenance, restaurant/store, and concession housing and maintenance.

Boulder Beach. The existing earth dikes that protect the developments in the Boulder Beach area would be regraded and reinforced with gabions to protect the area to the level of the probable maximum flood.

Las Vegas Wash. The concession dry boat storage and concession maintenance area would be relocated out of the probable maximum floodplain. Although the launch ramp is in the flood hazard zone, this is the only feasible location. In the event of a flood, a warning system at the ramp would advise incoming boaters to leave.

Overton Beach. Camping would be relocated out of the floodplain.

Temple Bar. The height of diversion dikes would be increased and the channels deepened to contain the probable maximum flood.

A complete discussion of actions that would be taken under alternative B to protect the flood-hazard areas from the effects of the probable maximum flood may be found in the "Alternative Development Concept Actions" section.

It was estimated that 410 people would be in the probable maximum floodplain in the daytime and none would be there at night. This represents 0.4 percent of the people expected to be in the area on a summer weekend day (96,000), and is 92 percent fewer people during the day and 100 percent fewer at night than would be expected under existing conditions.

At Katherine approximately 605 people would be protected from the probable maximum flood by relocating NPS maintenance facilities out of the floodplain and prohibiting the use of North and South Telephone Cove primitive use area. The removal of the 15 long-term and 33 short-term trailer village sites would reduce the number of people in the probable maximum floodplain by 50 during the day and 100 at night. All the remaining development at Katherine, except the dry boat storage area, would be protected by structural measures. Structural protection is expected to mitigate the hazard for 410 average summer weekend day users of the probable maximum floodplain. The five people expected to be at the dry boat storage area on an average summer weekend day would be protected by the warning system. All people in the probable maximum floodplain at night would be protected by structures.

Buy out and removal of concession facilities at Cottonwood under alternative B would result in a reduction of 1,455 people in the probable maximum floodplain as compared to existing conditions. The remaining projected 280 occupants of the floodplain at Cottonwood would receive no protection from a flood except for the warning system and evacuation plan.

At Willow Beach the relocation of the restaurant, store, campground, ranger station, NPS maintenance and concession housing, and concession maintenance out of the probable maximum floodplain, plus the complete removal of the motel and trailer village, would result in approximately 440 fewer people in the probable maximum floodplain on an average summer weekend day. Because no structural measures would be taken at Willow Beach, the remaining 1,476 people in the floodplain would only be protected by the warning system.

At Boulder Beach approximately 112 additional occupants of the campground and trailer village would mean that an additional 112 people would be at risk in the event of a probable maximum flood as compared with existing conditions. All of the expected 1,371 people (includes the 112 added) in the floodplain would be protected by structural measures and a warning system.

At Las Vegas Wash the situation would be the same as existing conditions, with only the launch ramp in the floodplain. About 40 people could be expected in the launch ramp area during the day, and any hazard they would be subject to would be mitigated by a warning system.

Relocation of the wash campground at Overton Beach out of the probable maximum floodplain would provide maximum levels of protection to approximately 275 daytime visitors and 550 nighttime users on an average summer weekend day. The 40 daytime users of the swim beach would receive no protection from a warning system.

All of the expected 1,167 daytime occupants of the probable maximum floodplain at Temple Bar would be protected by structural measures and a warning system.

Conclusion: After all flood mitigation actions were taken for alternative B, about 415 people in the daytime would remain in the probable maximum floodplain, where the hazard would be mitigated only by warning systems. That is a 92 percent reduction compared to existing conditions. At night no people would be in the areas only protected by warning systems. All other people in the probable maximum floodplain would be protected by structures like dikes and channels. For the 100-year flood there would be 200 people during the day and none at night; only a warning system would provide protection. That is an 84 percent and 100 percent reduction compared to existing conditions.

## IMPACT ON PROPERTY IN FLOODPLAINS

Many areas in the recreation area are subject to flash flooding. Flooding is most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor facilities are out of the floodplain. At Boulder Beach, all development is on a broad alluvial fan, with protection provided by earth dikes. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain. A more thorough discussion of floodplains may be found in the "Affected Environment" section of this document. The DCP graphics for each

developed area show the extent of the 100-year and probable maximum floods.

Table 20 shows development in the floodplain under each alternative. Alternative B would mitigate the flood hazard up to the level of the probable maximum flood through structural measures such as levees and channels and nonstructural measures such as relocation of facilities out of the floodplain and installation of warning systems. However, the property shown in the flood-hazard zone under alternative B would remain susceptible to flood damage after implementation of flood mitigation measures proposed in alternative B. The cost of replacing structures left unprotected in the 100-year floodplain would be approximately $1.6 million; for replacing those in the probable maximum floodplain, approximately $5.3 million. These costs do not include utilities, furnishings, equipment, vehicles, flood-control devices, debris removal, search and rescue, or expenses of victims.

Conclusion: The costs to replace facilities damaged by the 100-year flood would be approximately 4.9 percent of the costs under existing conditions. The cost to replace facilities damaged by the probable maximum flood would be about 98 percent of the costs under existing conditions.

## IMPACT ON RESERVOIR WATER QUALITY

Impacts would be the same as for the proposed action.

## IMPACT ON DESERT SPRING ECOLOGICAL COMMUNITIES

These impacts would be the same as for the proposed action.

## IMPACT ON SOILS

Soils of the area are extremely variable. Climate, vegetation, parent material, elevation, slope, and aspect all affect the development of these soils, which are characterized by a wide range of physical and chemical properties. Texture, permeability, depth, stoniness, organic content, alkalinity, and other properties are highly diverse and change quickly within short distances.

Under alternative B existing developments would be retained, major new areas would be developed, and the number of access points to the reservoirs would be increased. The offroad vehicle recommendations under the proposed action would be implemented. Lakeside roadways would not be extended from access points.

Under this alternative, offroad vehicle drivers would have the greatest number of approved roads to gain access to the reservoir, but once there they would not be able to get to more private areas over approved roadways. This would result in a continuation of the present situation because as visitation to the new areas increased, drivers would blaze new

routes to more secluded areas. Individuals wishing to hold offroad maneuvers in the desert would probably continue to do so, with soil damage continuing at about the same rate as under the no-action alternative. Research on the rehabilitation of offroad vehicle soil damage and implementation of a rehabilitation program would be initiated as in the proposed action.

The intent of this alternative would be the same as the proposed action in that mineral leasing would be restricted to the resource utilization subzone. The difference between the proposed action and alternative B would be in the amount of acreage contained in the resource utilization subzone. Under this alternative 320,550 acres would remain open to mineral leasing consideration to achieve the primary objective of this alternative (emphasizing resource utilization without compromising NPS recreational management responsibilities). Alternative B would also increase the amount of land where current prospecting permit applications have been filed, from 11,640 acres under the proposed action to 13,900 acres under alternative B. Existing leases, mining claims, and private mineral rights would be unaffected. Under this alternative, up to 32,400 acres of the NRA could be subject to mineral development on 18,487 acres of existing leases and 13,900 acres of pending permits (if approved).

Exploration activities associated with prospecting permits and oil and gas leases could result in damage to soils through excavation and erosion, with additional losses expected from associated excavation and removal for road construction and similar earthwork. Soil nutrients that have developed over long periods of time would be reduced in these disturbed soils by exposure to erosion and accelerated weathering; soil compaction and abnormally high soil temperatures could also occur. The reclamation potential of the disturbed area would be reduced unless proper care was taken to mitigate soil loss. Because of the diversity of soils in the recreation area, site-specific soils data would be necessary for detailed impact assessment and reclamation planning prior to mining approval.

Mineral leasing is not expected to significantly affect soils in any area of the park at the present time. Some damage or loss can be expected from sporadic exploration activities; however, the amount of acreage affected would be expected to be less than 300 acres over the next 10 years if the present mineral development trends continued in the area.

Conclusion: The construction of roadways and facilities under this alternative would destroy or severely damage about 238 acres of lithosols and red desert soils and cause minor disruptions in drainage patterns, which would temporarily increase the potential for erosion. The rate of damage and erosion from offroad vehicles would continue at its present level of 30 to 40 acres per year and would only be marginally offset by restoration efforts. Loss or damage to soils from mineral leasing would not be expected to be significant over the next decade, assuming mineral development activity followed current trends.

## IMPACT ON SIGNIFICANT NATURAL FEATURES

These impacts would be the same as for the proposed action.

## IMPACT ON THREATENED OR ENDANGERED SPECIES

The endangered bonytail chub, Gila elegans, and the threatened bald eagle, Haliaeetus leucocephalus, are the only two federally listed animal species that are known to occur in the NRA. There are no threatened or endangered plant species, proposed species, or critical habitat in Lake Mead.

There are several federal candidate plant and animal species that do, or could, inhabit or visit the recreation area. Some of these species are also listed by the states of Arizona and Nevada as threatened or endangered species or as species of concern. Table 18 identifies the status and legal classification of all these threatened, endangered, or other rare species. Of the 20 species, 18 are known in the recreation area. Of the 18, six are rare migratory transients with wide distributions outside the area. Thus, only 12 are of primary concern.

The intent of this alternative would be the same as the proposed action in that mineral leasing would be restricted to the resource utilization subzone. The difference between the proposed action and alternative B would be in the amount of acreage contained in the resource utilization subzone. Under this alternative 320,550 acres would remain open to mineral leasing consideration to achieve the primary objective of this alternative (emphasizing resource utilization without compromising NPS recreational management responsibilities). Alternative B would also increase the amount of land where current prospecting permit applications have been filed, from 11,640 acres under the proposed action to 13,900 acres under alternative B. Existing leases, mining claims, and private mineral rights would be unaffected. Under this alternative, up to 32,400 acres of the NRA could be subject to mineral development on 18,487 acres of existing leases and 13,900 acres of pending permits (if approved).

Alternative B would place 878,450 acres or 58 percent of the NRA in the natural zone. Known habitat or potential habitat for rare, threatened, or endangered plant and animal species would be further protected by placing these areas in either the environmental protection subzone or the outstanding natural feature subzone of the natural zone. Areas open to mineral leasing would be 320,550 acres or 22 percent of the NRA in the resource utilization subzone and an additional 32,400 acres of existing leases and pending prospecting permits.

About 32,400 acres of the NRA have the highest potential for mineral development--18,487 acres of existing leases and 13,900 acres of pending prospecting permits (if approved). None of the leases and pending permits are in areas where they could potentially affect any threatened or endangered animal species. Two existing leases and one pending prospecting permit are located within 5 miles of known locations of candidate threatened or endangered plant species. Additional surveys on these leases or permits could reveal additional populations of these plants. Potential threats to these plants include physical destruction of populations or habitat and illegal collection. When specific mineral development proposals were received in these areas, surveys would be conducted and protective stipulations applied to the plan of operation, but it is not certain that all potential impacts would be avoided.

Developments under alternative B that could affect rare, threatened, or endangered species include the Fire Mountain developed area and improved access points in the Cottonwood East vicinity and at Detrital Bay. None of the developments would be in areas identified as habitat for these species, but some would be close to identified habitat areas. Any effects on threatened or endangered species would be due to increased visitation in habitat areas near new developments.

Areas used by the threatened bald eagle are high cliffs well above water. These areas are remote and lightly used only during winter; they are not used for nesting. Although visitor use would likely increase as a result of new development at Fire Mountain and at the Detrital Bay access point, it would still remain very low during winter and would likely not affect eagles.

Visitation is now very light in the Cottonwood East vicinity, where the proposed access point could affect the endangered bonytail chub recovery cove. The endangered species recovery team for the bonytail chub would be consulted before locating the access point so as to minimize impacts on the chub.

The effects of new development on threatened or endangered species would be further mitigated during the period before construction (about 10 years). Both categories of species would be closely monitored as visitation increased. Management recommendations based on this monitoring would allow the areas to be developed with minimal effects on these species.

Conclusion: Impacts on threatened or endangered species under alternative B would be slight.

## IMPACT ON VEGETATION

Approximately 71 percent of the NRA is dominated by the creosotebush community. This community type is widespread throughout the desert southwest and is the representative low elevation vegetation type in the Mohave and Sonoran deserts. Vegetation typical of higher elevations includes blackbrush, sagebrush, and pinyon/juniper. These vegetation types are common throughout the intermountain region.

Precipitation rates in low elevation communities are generally less than 5 inches annually, while higher elevations receive 5 to 15 inches. Because of these low precipitation rates, revegetation rates on disturbed sites may be as long as 50 to 75 years.

The intent of alternative B would be the same as the proposed action in that mineral leasing would be restricted to the resource utilization subzone. The difference between the proposed action and alternative B would be in the amount of acreage contained in the resource utilization subzone. Under alternative B, 320,550 acres would remain open to mineral leasing consideration to achieve the primary objective of this alternative. Alternative B would also increase the amount of land where current prospecting permit applications have been filed from the 11,640

acres available under the proposed action to 13,900 acres under alternative B. Existing leases, mining claims, and private mineral rights would be unaffected.

Under this alternative, up to 32,400 acres of the NRA could be subjected to mineral development on 18,487 acres of existing leases and 13,900 acres of pending prospecting permits (if approved).

Impacts to vegetation under this alternative would be greatest if an ore deposit were discovered and production of a mine initiated. Several hundred acres of vegetation could potentially be destroyed through development of mine surface facilities, access roads, and tailings piles. However, given the history of Lake Mead leasing, this level of development is unlikely. Exploration activities on mineral and oil and gas leases would disturb only a small amount of native vegetation.

Conclusion: None of the impacts to vegetation under this alternative would be significant.

## IMPACT ON DESERT BIGHORN SHEEP

These impacts would be the same as for the proposed action.

## IMPACT ON VISITOR CROWDING/CONGESTION

Existing conditions at the developed areas are extremely crowded and congested on weekends during the summer. Holiday weekends are the worst. Memorial Day weekend has had visitation of 254,000. Annual visitation is around 6.5 million and expected to increase to around 9 million by the year 2000. Currently it is not unusual for visitors at several of the larger developed areas to wait up to an hour to launch their boats and twice that long on a holiday weekend. Several of the popular campgrounds and motels are full during the summer. At several developed areas confusing circulation systems frustrate first-time visitors from easily finding their way around. Illegal parking along road shoulders is a common problem that results when existing parking areas fill.

Alternative B would accommodate increasing visitor use and solve existing crowding/congestion problems by expanding and improving existing developed areas, improving existing access points to the lakeshore, and providing new developed areas. (For a full discussion of these actions, refer to the "Alternative Development Concept Actions" section.) These actions include many diverse proposals intended to accommodate increasing visitation or solve crowding/congestion. To understand the magnitude of these proposals, the increases in parking, overnight accommodations, and launch ramps are used as examples. Alternative B includes an increase of 1,880 parking spaces (19,660 spaces exist), or an increase of 10 percent. There are 1,755 overnight accommodation units (a unit is either one campsite, one motel room, or one RV site). Alternative B would increase them by 90 units, or an increase of 5 percent. There are 73 launch ramp lanes, and alternative B would add 16, an increase of 22 percent.

Over the life of the plan, visitation is expected to increase by about 68 percent, and visitor facility proposals under alternative B call for capacities to increase 5 to 40 percent beyond existing levels. This disparity between expected use and proposed facility levels indicates that crowding/congestion could increase beyond existing levels. However, it might not get any worse than existing levels, and it might actually be reduced because of proposals that would reduce crowding/congestion but that cannot be quantified. For example, circulation improvements would facilitate vehicle and pedestrian movements in several developed areas.

Conclusion: The facility improvements and expansions proposed under alternative B would tend to hold crowding/congestion near existing levels or result in increased crowding and congestion, even as visitation increased.

## IMPACT ON VACATION CABIN SITE RESIDENTS

Lake Mead NRA has three lakefront areas in which sites may be leased for privately owned vacation cabins. These areas are Katherine Landing, which has 39 cabin sites, Stewarts Point, which has 60 cabin sites, and Temple Bar, which has 36 cabin sites. Cabin site occupancy is for personal, not commercial, use. Department of the Interior regulations (43 CFR 21) prohibit granting new leases for new cabin site occupancy within Lake Mead. The objective under alternative B would be to spread visitor use around the lake. Implementation would affect eight cabin sites at Katherine Landing. Cabin sites at Temple Bar and Stewarts Point would not be affected. Extensions of leases up to five years would continue to be granted until the need for public use of the cabin site areas dictated termination. The determination of public need would be made two years in advance of the common expiration date.

At Katherine Landing eight cabins would be removed and replaced with public facilities, including a 20-table picnic area, four-lane launch ramp, and 325-vehicle parking area. The launch ramp in this area would allow visitors access to a floating facility in the north end of the Katherine zone. Eight cabin site residents would be removed from their permanent or seasonal homes in this area. The social impact resulting from removal of these eight cabin sites would be most felt by the residents that would no longer be able to live or vacation close to the lake. These people would have to relocate to other areas within the recreation area or to communities outside the area. This would be a traumatic event to many of these occupants, who have spent as many as 30 years in their cabins. Throughout the years, many have invested their time, energy, and creativity in landscaping and home improvements that they hoped to enjoy for the rest of their lives. Any financial compensation they would receive could not alleviate the loss that many would feel in leaving their vacation homes. There could be some economic impact to some of the occupants because the government is not required to relocate renters and lessees. The number of cabin sites adversely affected is eight out of 135 for the entire NRA or 6 percent of the total number of cabin sites.

Conclusion: Cabin site residents at Katherine Landing, Temple Bar, and Stewarts Point would not be affected by this alternative. Cabin site residents adversely affected by the proposal would be those eight cabin

sites at Katherine Landing which would be removed and replaced with public facilities.

## IMPACT ON TRAILER VILLAGE RESIDENTS

Most of the developed areas around the lakes have concessioner-operated trailer villages for long- and short-term visitors.

The existing number of long-term, short-term, and RV sites available at each area and the proposed alternative B actions are presented below.

| Area | Existing Number of Sites (Long/Short/RV) | Alternative B Actions |
|---|---|---|
| Katherine Landing | 104/39/0 | Relocate 15 long-term and all 33 short-term sites |
| Cottonwood Cove | 223/75/0 | Remove all from flood-hazard zone |
| Fire Mountain | 0/0/0 | Add 50 RV sites |
| Willow Beach | 60/18/0 | Remove all from flood-hazard zone |
| Boulder Beach | 215/75/0 | Add 75 short-term sites |
| Las Vegas Wash | 0/0/0 | Same as no action |
| Callville Bay | 94/6/0 | Same as no action |
| Boxcar Cove | 0/0/0 | Same as no action |
| Echo Bay | 69/58/0 | Same as no action |
| Overton Beach | 19/13/0 | Same as no action |
| Temple Bar | 103/13/0 | Same as no action |
| Totals | 887/297/0 | |

The only trailer village residents who would be affected under this alternative would be those relocated because of flood hazard. They include 15 long-term and 33 short-term residents who would be relocated within the Katherine area; all 223 long-term and 75 short-term residents at Cottonwood Cove; and all 60 long-term and 18 short-term residents at Willow Beach. The residents at Cottonwood Cove and Willow Beach would be most adversely affected, because they would be relocated out of the developed areas entirely. These residents would be safer from flood hazard (discussed under another impact topic); however, there could be social impacts resulting from relocation because these residents would no longer be able to live or vacation close to the lake. This could be a traumatic event to many of these occupants, who have spent as many as 30 years in their trailers. Throughout the years, many have invested their time, energy, and creativity in landscaping and home improvements that they hoped to enjoy for the rest of their lives. There could be some economic impact to some of the occupants because the government is not required to relocate renters and lessees.

Conclusion: Implementation of this alternative would result in temporary disruption of the lives of some long- and short-term residents at Katherine Landing. Long- and short-term residents at Willow Beach and Cottonwood Cove would be most adversely affected by removal of the trailer villages at these locations. Such removal amounts to a loss of 32 percent of all NRA long-term sites and 31 percent of all NRA short-term sites.

## IMPACT ON LEVEL OF CONCESSION OPERATIONS

Table 32 summarizes the level of services to be provided by the concessioner in alternative B.

Conclusion: The level of concession services compared to existing conditions would decrease in five of the nine categories under this alternative. The decrease would range from 9 percent in gas station pumps to 32 percent in the number of long-term trailer spaces. One category--gas docks--would not change. Increases would range from 4 percent in restaurant seats to 61 percent in the number of moorings.

Table 32: Impact on Level of Concession Services, Alternative B

| | Trailer Village Long-Term/ Short-term Sites | Motel Units | Restaurant Seats | Store Square Feet | Marina Slips/Moorings | Rental Boats # Houseboats/ # Other | Dry Boat Storage Spaces | Gas Station # Pumps | Gas Dock # Boat Capacity |
|---|---|---|---|---|---|---|---|---|---|
| Katherine Zone | | | | | | | | | |
| Katherine Landing | 104/39 | 52 | 117 | 3,600 | 764/0 | 75/41 | 210 | 2 | 14 |
| Lower Mohave East | 0 | 0 | 0 | 1,000 | 0 | 0/0 | 0 | 0 | 4 |
| Cottonwood Zone | | | | | | | | | |
| Cottonwood Cove | 0 | 0 | 0 | 0 | 0 | 0/0 | 0 | 0 | 0 |
| Fire Mountain | 0/50 | 25 | 50 | 3,000 | 200/0 | 0/0 | 120 | 0 | 0 |
| Willow Beach Zone | | | | | | | | | |
| Willow Beach | 0 | 0 | 100 | 1,000 | 182/16 | 0/40 | 120 | 0 | |
| Boulder Basin Zone | | | | | | | | | |
| Boulder Beach | 215/150 | 44 | 314 | 5,500 | 875/0 | 0/39 | 275 | 0 | |
| Las Vegas Wash | 0 | 0 | 54 | 3,300 | 595/3 | 0/35 | 100 | 0 | 3 |
| Callville Bay | 94/6 | 0 | 36 | 500 | 755/0 | 15/33 | 111 | 2 | |
| Boxcar Cove | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Echo Bay Zone | | | | | | | | | |
| Echo Bay | 69/58 | 52 | 120 | 9,000 | 321/0 | 70/18 | 97 | 4 | |
| Overton Beach Zone | | | | | | | | | |
| Overton Beach | 19/13 | 0 | 0 | 0 | 0/140 | 0/6 | 40 | 0 | 3 |
| Virgin/Temple Zone | | | | | | | | | |
| Temple Bar | 103/13 | 22 | 76 | 1,500 | 980/0 | 45/15 | 200 | 2 | |
| Totals: Alternative B | 604/329 | 195 | 867 | 28,400 | 4,672/159 | 205/227 | 1,273 | 10 | 24 |
| Existing Conditions | 887/297 | 218 | 834 | 25,600 | 3,317/99 | 170/258 | 1,328 | 11 | 24 |
| Net change | -283/+32 | -23 | +33 | +2,800 | +1,355/+60 | +35/-31 | -55 | -1 | 0 |
| Percent change | -32/+11 | -11 | +4 | +11 | +41/+61 | +21/-12 | -4 | -9 | 0 |

## IMPACT ON MINERAL LEASING OPPORTUNITY

The intent of alternative B would be the same as the proposed action in that mineral leasing would be restricted to the resource utilization subzone. The difference between the proposed action and alternative B would be in the amount of acreage contained in the resource utilization subzone. Under alternative B, 320,550 acres of the NRA would remain open to consideration for mineral leasing (an increase in the size of the resource utilization subzone of 189,400 acres over the proposed action). Most of the lands added to leasing consideration would be north of the lake in the Overton Arm, Gold Butte, and Grand Wash areas and in the Malpais Mesa area south of Willow Beach.

Mineral development could take place on the 18,487 acres covered by existing leases within the NRA. Of the 32,600 acres of land already applied for prospecting permits, approximately 13,900 acres would remain available for exploration. The remaining 18,700 acres would be withdrawn from further mineral leasing consideration. Most of the pending applications that would be affected by this withdrawal are for uranium in the Shivwits Plateau zone of the NRA. Existing mining claims and private mineral rights would be unaffected.

The immediate impacts of this alternative on mineral leasing opportunities would be similar to the impacts described under the proposed action--the Shivwits Plateau zone would remain unavailable for further mineral leasing consideration. None of the 17,590 acres of pending permits would be approved, thus preventing any further uranium exploration on the Shivwits Plateau.

The major difference between this alternative and the proposed action is that approximately 60 percent more land would be available for mineral leasing consideration under alternative B.

The highly speculative nature of the mineral resources within the NRA indicates that the long-term gains obtained from preserving the recreational values of the park far outweigh the uncertain, relatively short-term economic gains from mineral development.

Conclusion: This alternative would not have a significant effect on the opportunity to develop a mineral resource within the NRA.

## IMPACT ON WILDERNESS LANDS

Alternative B emphasizes maximum use of the resources of the NRA and a broader range of choices and experiences for visitors.

To allow more resource use and to also preserve scenic vistas around the lake, this alternative would protect a 1.5-mile-wide corridor of land back from the shoreline of both lakes. This would be different from the proposed action, which seeks to preserve scenic vistas through protection of entire natural features. Alternative B would have the largest special use zone and resource utilization subzone (320,550 acres) of all the alternatives. Many areas possessing wilderness values would be in the

resource utilization subzone and would be subject to mineral leasing. Areas containing significant natural resource values would be in the natural zone. Many of these areas also possess wilderness values.

Although no lands are proposed for wilderness designation, the Wilderness Suitability map in the "Affected Environment" section indicates those lands that meet or potentially meet the criteria of the Wilderness Act of 1964. The following units are keyed by number to that map and include most of the lands in the recreation area that possess primitive characteristics. Boundary lines of the units follow topographic features, access roads, and recreational area boundary lines, section lines, and a line marking a 300-foot horizontal setback from the high waterlines of Lakes Mohave and Mead.

Units 1 and 2 (total, 40,605 acres) center on the Newberry Mountains, which rise to an elevation of 5,600 feet and offer a cool refuge from the heat of the surrounding desert lowlands. Davis Dam, the Mohave power plant, Katherine Landing, and Bullhead City are developments visible from the southern and eastern portions of this unit. The resource utilization subzone would include 3,755 acres.

Unit 3, Nellis Wash (15,870 acres), includes portions of the isolated Newberry Mountains along the western side of the recreation area. Fingerlike drainages and alluvial fans extend eastward from the mountains toward Lake Mohave. Some mining has occurred previously within the unit. All of the lands within this unit would be placed in the resource utilization subzone.

Unit 4, Cottonwood Valley, potentially meets the criteria of the Wilderness Act in spite of outstanding mineral reservations. This 15,295-acre gently sloping outwash provides solitude in a primitive setting just to the north of a major development at Katherine Landing. The resource utilization subzone would include 9,592 acres.

Unit 5, the Black Mountains capped by 2,000-foot Mount Davis, provides a scenic background for Lake Mohave. Approximately 17,970 acres are included in this unit. Scattered washes and side canyons transect the Black Mountains from east to west as they wend their way to the Colorado River. The resource utilization subzone would include 10,925 acres.

Unit 6, Opal Mountain (17,635 acres), contains a portion of the Eldorado Mountains, gently rolling hills, and outwashes extending to Lake Mohave. Rugged mountains, secluded valleys, and flat alluvial fans provide opportunities for seclusion in a setting of scenic splendor. The resource utilization subzone would include 12,735 acres.

Units 7, 8, 10, 11, and 12, Fire Mountain and Black Canyon, contain some of the most spectacular and rugged terrain within the recreation area. They consist of steep, barren rocky crags, which begin at an elevation of 645 feet and terminate at an elevation of approximately 2,200 feet. These units consist of 70,470 acres and combine to form the "Black Canyon" of Lake Mohave, which is noted for its hot springs and cool Colorado River. This area is a popular spot for visitors to see sharp and

abrupt canyon walls and a myriad of geology. Units 11 and 12 only potentially meet the criteria of the Wilderness Act because the Bureau of Reclamation has identified these areas as potential locations for reclamation facilities ranging from Hoover Dam modifications to new transmission line corridors. The resource utilization subzone in these units would include 18,571 acres.

Unit 9, Eldorado Mountain, contains approximately 29,665 acres of the picturesque and rugged Eldorado Mountains. The unit is a maze of peaks and side canyons with vertical cliffs extending to the edge of the Colorado River. The resource utilization subzone would include 8,705 acres.

Unit 13, Kingman Wash, contains approximately 40,835 acres. The undulating Black Mountains typify the topography of the region. Access to the unit is provided on all sides by existing road corridors. The resource utilization subzone would include 9,970 acres.

Unit 14, Bonelli Landing, comprises 13,875 acres of mainly alluvial fans and separates the hilly mountainous area of unit 13 from the gypsum beds of unit 21. This unit contains historic mining diggings and some archeological remains in the form of petroglyphs. Access to this unit is by the road to Bonelli Landing and Temple Bar. The resource utilization subzone would include 1,500 acres.

Units 15, 16, and 17, Pinto Valley, comprise approximately 38,340 acres of rugged hills and highly scenic valleys. These units contain Guardian Peak, which is one of the highest peaks within the area and is used as a navigational aid. The northern side of Boulder Canyon is formed by these units, where steep cliffs or barren rock extend into the cool blue waters of Lake Mead in a dramatic fashion. Pinto Valley is a much-photographed topography because of the red sandstone outcroppings that merge with the green desert vegetation and the grays, browns, and yellows of the desert floor. None of these lands would be open to mineral leasing.

Unit 18, Cathedral Wash, contains 18,820 acres. Mountainous terrain representing the northeast extremities of the Black Mountains dominates the area and contrasts with the flat surface of Lake Mead. None of these lands would be open to mineral leasing.

Unit 19, Overton (24,040 acres), consists of flat to "badland-like" lands sloping westward from mountainous terrain to a road corridor east of the recreation area boundary. The unit forms the scenic background for lake users and for shoreline users on the west side of Overton Arm. These flat outwashes lack the spectacular contrasts found in other units and portray a typical desert landscape. This unit has retained its primitive characteristics and affords an opportunity for seclusion and an unconfined type of recreation. The resource utilization subzone would include 13,650 acres open to mineral leasing.

Unit 21--White Hills, unit 22--Temple Bar, and unit 23--Gregg's Hideout, all in the White Hills, offer isolation, scenic views, and historic attractions. This rolling hill country includes some evidence of earlier

mining activities and trails. These activities did not scar the area excessively, and many scars have healed to the point of not being noticeable. Access to the area is possible by car on existing roads, by hiking from developed areas such as Temple Bar, or by boat from Lake Mead. These three units contain approximately 52,130 acres; the resource utilization subzone would include 32,086 of this total acreage.

Units 20 and 24-32 are known as Twin Springs, Scanlon Wash, Hiller Mountains, Hell's Kitchen, Indian Hills, Cockscomb, Grand Wash Cliffs, Iceberg Ridge, South Cove, and Pearce Ferry. The units (total, 135,688 acres) contain rugged mountain ranges that provide a scenic background for the Virgin Basin section of Lake Mead. Gently sloping outwash fans extend from the mountains to plunge abruptly into the reservoir. The resource utilization subzone would include 71,445 acres.

Unit 33, Shivwits Plateau, contains approximately 83,980 acres. Diverse activities occur in this remote section of Lake Mead, ranging from hunting to grazing. Due to a higher altitude, the region is cooler, has more precipitation, and supports pinyon/juniper and ponderosa pine forests and a wider variety of wildlife than can be found in the rest of the recreation area. Kelly Point, Twin Point, and other points along the rim permit spectacular views of the Grand Canyon. Because most of the land within this unit is subject to mineral reservation, the unit only potentially meets the criteria of the Wilderness Act. Several of the units appear to be narrow and splintered by access roads. However, when considered along with the adjacent proposed wilderness in Grand Canyon, it is apparent that these would form a significant contiguous wilderness unit. None of these lands would be open to mineral leasing.

Unit 34--Andrus Point, unit 35--Whitmore Point, and unit 36--Lava consists of approximately 58,430 acres in the northeast sector of the recreation area. Contained within these units are Parashant, Andrus, and Whitmore Canyons; all are precipitous side canyons of significant grandeur that drain into the Grand Canyon. The entire area is undeveloped land retaining its primeval character, and it provides an opportunity for solitude or a primitive and unconfined type of recreation in a scenic setting of steep escarpments, colorful red walls, and deep canyons. Geologic formations and processes in evidence here may provide information on the origin of the Grand Canyon. Archeological sites of several Indian cultures, including the Virgin Anasazi and more recently the Paiutes, are also found here. Adjacent primitive areas of Grand Canyon National Park provide for a contiguous unit of primitive lands extending westward from the Pine Mountains across the Sanup and Shivwits plateaus to the Grand Wash Cliffs. None of these lands would be open to mineral leasing.

Conclusion: Designating 320,550 acres as open to mineral leasing within the NRA would affect 199,312 acres, or 37 percent, of those lands that meet the criteria of the Wilderness Act and 10,132 acres, or 8 percent, of those lands that potentially meet the criteria. Mining activities as a result of mineral leasing in those areas could unnaturally scar the landscape and alter the wilderness character of these lands, making wilderness values on at least part of these lands lost to any future possible designation. These are lands which primarily met the roadless requirements of the Wilderness Act and are not lands possessing significant resource values.

Table 33: Summary of the Effects of Alternative B on Wilderness Lands

| | Acres Meeting or Potentially Meeting Wilderness Act Criteria | | Acres Affected | |
|---|---|---|---|---|
| | Wilderness | Potential Wilderness Area | Wilderness | Potential Wilderness Area |
| 1 | 7,650 | | | |
| 2 | 32,955 | | 3,755 | 0 |
| 3 | 15,870 | | 15,870 | 0 |
| 4 | 0 | 15,295 | 0 | 9,592 |
| 5 | 17,970 | 640 | 10,925 | 0 |
| 6 | 17,635 | 0 | 12,735 | 0 |
| 7 | 15,145 | | 2,255 | |
| 8 | 25,605 | | 16,316 | 0 |
| 9 | 29,665 | | 8,705 | 0 |
| 10 | 2,045 | | | |
| 11 | 0 | 14,645 | | |
| 12 | 0 | 13,030 | | |
| 13 | 40,835 | | 9,970 | 0 |
| 14 | 13,875 | | 1,500 | 0 |
| 15 | 17,115 | | | |
| 16 | 6,680 | | | |
| 17 | 14,545 | | | |
| 18 | 18,820 | | | |
| 19 | 24,040 | | 13,650 | 0 |
| 20 | 10,610 | | 5,120 | 0 |
| 21 | 25,580 | | 9,760 | 0 |
| 22 | 16,665 | | 13,110 | 0 |
| 23 | 9,885 | 80 | 9,216 | 80 |
| 24 | 22,095 | | 15,770 | 0 |
| 25 | 8,545 | | 5,120 | 0 |
| 26 | 14,620 | | 3,960 | 0 |
| 27 | 7,720 | | | |
| 28 | 14,020 | | 11,025 | 0 |
| 29 | 13,895 | | | |
| 30 | 15,143 | 460 | 8,330 | 460 |
| 31 | 16,480 | | 11,195 | 0 |
| 32 | 12,100 | | 10,925 | 0 |
| 33 | 0 | 83,980 | | |
| 34 | 14,905 | 0 | | |
| 35 | 32,215 | 0 | | |
| 36 | 10,710 | 600 | | |
| Totals | 545,645 | 128,730 | 199,312 | 10,132 |
| Percentage | 100 | 100 | 37 | 8 |

# CONSULTATION AND COORDINATION

## CONSULTATION AND COORDINATION

### SCOPING PROCESS AND ISSUES AND ALTERNATIVES RAISED

Meetings, public workshops, and surveys were an integral part of the scoping process. Their purpose was to identify all issues, alternatives, and impact topics that should be considered in planning and to keep the public informed throughout plan formulation. On April 7, 1982, a notice of intent to do an EIS for the Lake Mead GMP and to begin scoping for that planning process was issued in the Federal Register (vol. 47, no. 67, p. 14962).

#### Visitor Survey

From Memorial Day to Labor Day in 1978 and Easter week in 1979, questionnaires were distributed to people visiting Lake Mead National Recreation Area. The objectives of the survey were to determine the characteristics of visitors to Lake Mead, what activities visitors were currently engaged in at Lake Mead, and what additional services and facilities were needed at Lake Mead to serve the visitor. Results of this survey are contained in a Denver Service Center report (USDI 1982a).

#### Spring Newsletter

In the spring of 1982, a newsletter listing those GMP issues identified by the Park Service was sent to those publics interested in Lake Mead National Recreation Area. From the response, the issues of most concern to the public were as follows:

Wilderness areas should be included in Lake Mead National Recreation Area

Mining and mineral leasing is acceptable in the recreation area within limits

Endangered species should be protected

Visitor contact stations should be supported

Black Canyon raft trips should be provided

Areas should be closed when capacity is reached on holiday weekends

Additional development is needed at Lake Mead

The tamarisk should be eradicated where it encroaches on beach space.

## Planning Team's Analysis

During 1982 the planning team gathered extensive amounts of data. They spent time in the recreation area to familiarize themselves with the area and to identify sensitive resources, problems, planning issues, and alternative solutions. They contacted numerous agencies and individuals during this process. During 1983 and 1984 the analysis continued, while alternatives and their impacts were further specified.

## Public Meetings

Four open-house meetings were conducted as part of the scoping process. At Bullhead City, 16 people attended, 14 at Las Vegas, five at Pasadena, and 16 at Santa Ana plus a college class of 35. At each open house, the public was invited to read the graphics on display throughout the room, watch a narrated slide show on Lake Mead NRA planning issues (except Pasadena), and discuss their ideas and concerns with one or more of the National Park Service representatives. Although attendance at the meetings was lower than hoped for, those who came represented a variety of interests and opinions.

The most common issues of discussion at the openhouses were as follows:

Additional land access to the lake is needed for day users and visitors who do not own boats

More launch ramps are needed around the lake to alleviate the congestion at developed areas

Trash and sanitation problems at remote coves need to be solved

Mining and mineral leasing is acceptable in Lake Mead NRA as long as it is not visible and extensive site clean-up requirements are enforced

No additional, major developments are needed in the NRA

Some of the additional comments were as follows:

The launch ramp procedure at Katherine Landing is inadequate for the numbers of people who use that facility

Better land access to Telephone Cove and No Ski Cove is needed for day-use and beach-oriented activities

Trash was considered a major problem on Lake Mohave

Some coves need to be zoned for fishing to alleviate the conflicts between fishermen and skiers

More roads need to be legalized for vehicle access to the lake

Concern was expressed over any commercial raft trips that might increase use and environmental degradation in the Black Canyon

Interest was expressed in helping the National Park Service clean up trash around the lake in exchange for a free camping space or other nominal privileges

A greater National Park Service presence is needed (e.g., more ranger patrols)

Summer Newsletter

In the summer of 1982 a newsletter was sent to those interested in the General Management Plan (GMP) for Lake Mead National Recreation Area. This newsletter summarized the comments from the spring newsletter and public meetings. The newsletter again identified the issues for the plan and modified them in consideration of public comments.

Alternatives Workbook

In December 1982, 309 alternatives workbooks were distributed for the Lake Mead National Recreation Area GMP. An additional 91 workbooks were distributed at a question/answer session. Of the 122 responses, 58 percent were from the mailing, while 42 percent were from those distributed at the recreation area or session.

The return rate for the workbook was 30.5 percent (out of the 400 distributed.)

The parkwide comments were varied, with 31 persons responding to this comment sheet. Approximately half of those making comments selected a preferred parkwide alternative; of these, a majority preferred alternative C (became proposed action).

Of the 48 people who responded to the general development concepts, alternative C was preferred for all developed areas, with the exception of Katherine. This difference at Katherine is a reflection of the cabin site lessees who selected the no-action alternative as their preferred concept.

The following are summaries of reactions to the specific development proposals for each of the nine planning zones:

Katherine Zone, 41 responses

For flood mitigation, access and parking, and launch ramps, a majority of the respondents selected alternative C. However, for the remainder of the development proposals, the no-action alternative was selected. Respondents indicated that Arrowhead and Shoshone coves were preferred for improved access, while Tokyo Bay was selected as the preferred site for a new developed area.

Cottonwood Zone, 29 responses

Alternative C was the preferred alternative for a majority of the respondents for each of the developed proposals. Six-Mile Cove was selected as a location for improved access, with Fire Mountain as the site for new development.

Willow Beach Zone, 30 responses

The no-action alternative was selected by a majority of respondents for: flood mitigation, parking, launch ramp, courtesy dock, swim beach, trailer village, and all concession facilities and services. On the other hand, alternative A was preferred for the picnic area, campground, NPS boat dock and ranger station, and interpretation/ information development proposals. Finally, alternative C was selected for the access, NPS maintenance, and NPS housing proposals. No locations were indicated for either improved access or new development.

Boulder Basin Zone, 28 responses

A majority of the respondents felt that alternative C was appropriate for the launch ramp, courtesy dock, swim beach, ranger station, interpretation/information, NPS boat dock, maintenance and housing, and picnic area proposals. The no-action alternative was preferred for the trailer village, gas station, and gas dock. Alternative A was selected for the remainder of the development proposals, which encompassed concessioner services and facilities, campground, flood mitigation, access, and parking. Improved access was indicated for Boxcar Cove, as well as improvements on Northshore and Lakeshore drives. Few respondents indicated a desired site for new development; of those who did, Boxcar Cove was the favorite.

Echo Bay Zone, 15 responses

Alternative A appeared to be the preference of a majority of the respondents for the development proposals in this zone. However, for cabin sites, trailer village, concession maintenance and housing, and gas station and dock, the no-action alternative appeared to be the preferred alternative. Alternative C was selected for the flood mitigation, launch ramp, and swim beach proposals. Again, few people responded to the improved access issue; of those who did, Stewarts Point was preferred. Rogers Spring was selected for improved interpretive programs. No preferences were indicated for a new developed area in this zone.

Overton Beach Zone, 15 responses

Alternative C was selected for the flood mitigation, access and parking, trailer village, motel, rental boat, gas station, and gas dock proposals. No majority opinions were indicated for improved access or new development areas.

Virgin/Temple Zone, 18 responses

With the exception of flood mitigation, alternative A was preferred for the development proposals. Alternative C was preferred for flood mitigation. Detrital Bay was selected as the site for both improved access and new development.

Gregg Basin/Grand Wash Zone, 17 responses

A majority of respondents felt that the no-action alternative was preferred for this zone. The exceptions were for the access and parking, launch ramp, courtesy dock, swim beach, and picnic area proposals, where alternative C was preferred. Pearce Ferry was selected as an improved access site. Only two people responded to the new developed area issue; they both selected Pearce Ferry.

Shivwits Plateau Area, 10 responses

The no-action alternative was selected by a majority of respondents for all development proposals.

## Additional Public Input

In response to public inquiries about the alternatives workbook, an informal question/answer session was held in Las Vegas during January 1983. The primary objectives of this session were: to distribute workbooks to those who had not received them in the mail; to answer questions about the workbooks; and to provide additional information to explain and clarify issues. There were 115 people in attendance.

The following are some of the comments, related to the alternatives workbook, which were made during the course of the meeting:

More road access to the shore for fishing is needed.

The possibilities of concessioner-managed launch ramps and launching fees were raised.

Breakwaters for slips are needed.

Additional roads would be a burden to staffing capabilities.

Need for hobie cat and sailboard launch and use areas.

The number and impacts of houseboats were raised.

## Consultation with Agencies During Preparation of the Proposed Plan

On May 3, 1982, a meeting was held for all interested federal, state, and local government agencies; 16 people attended this meeting and included representatives from: Bureau of Land Management, U.S. Fish and Wildlife Service, Bureau of Reclamation, Arizona Department of Game and

Fish, Nevada Department of Wildlife, and Clark County Planning Department.

The agencies were primarily interested in how the planning process would proceed, what the public response was to date, and how and when the National Park Service wanted the agencies involved in the process.

The Arizona Department of Game and Fish was specifically interested in tamarisk control and wanted to be involved in habitat manipulations related to such controls. They also requested information on federally listed endangered and threatened species for the national recreation area. The BLM expressed interest in the wilderness plan and the results of the visitor survey and carrying capacity studies. Other agencies expressed appreciation for the opportunity to comment at this early stage of the planning process.

Agencies were also contacted for information on numerous occasions. Refer to appendixes B and C for U.S. Fish and Wildlife Service and Arizona and Nevada cultural resource consultations.

## ISSUES, ALTERNATIVES, AND IMPACT TOPICS FROM SCOPING

### Those Considered

Throughout the scoping process the only full alternatives developed were those suggested by the planning team in the alternatives workbook. They have been modified but are essentially the same as those presented previously in the "Alternatives Including the Proposed Action" section.

The issues addressed in those alternatives are summarized in the "Issues Addressed by the Plan" section at the beginning of this document. Almost all issues raised are addressed. The impact topics considered are described in the beginning of the "Environmental Consequences" section.

### Those Not Further Considered

Closing Areas When Capacity is Reached on Holiday Weekends. Closing developed areas to further entry when they become overcrowded is not acceptable to most members of the public. This issue is also sensitive politically and is not a realistic solution today. However, this issue is generally addressed in the "Carrying Capacities" section.

Zoning Some Coves for Fishing. This issue is only addressed indirectly. Areas of concentrated use where use conflicts are the greatest are proposed as flat-wake zones. Directing zoning areas for only fishing would limit too many other legitimate uses.

Air Quality. Problems are in a regional airshed from major population centers and power plants. Even dust from dirt roads is not significant locally by comparison to regional problems. Proposals in any alternative, including projected visitation increases, would not alter existing air quality.

Cultural Resources. As described in the "Affected Environment" section, all known significant cultural resources have been identified. However, none of these will be affected by any alternatives. To ensure protection of currently unknown cultural resources, preconstruction or premineral leasing surveys will be conducted for all land that could be affected by specific construction or leasing proposals.

Land Protection Issues. The General Management Plan will only summarize decisions already made in the Land Protection Plan and will not propose any new actions. The Land Protection Plan had its own assessment. See the "Land Protection" section for a full description of the issues and management direction on boundary revisions, state and private lands, Santa Fe Pacific mineral rights, Arizona indemnity selection program, Hualapai Indian reservation lands, Bureau of Reclamation withdrawal lands, easements and utility corridors, and special activities on nonfederal land.

Resource Management Issues. The General Management Plan will only summarize decisions already made in the Resources Management Plan and will not propose any new actions except for mining/mineral management and illegal use of vehicles off approved roads. The Resource Management Plan has its own assessment. See the "Resources Management" section for a full description of the issues and management directions on natural resources management--fishing, hunting, and trapping management, tamarisk control, exotic species control, air and water quality monitoring, fire management, threatened or endangered species management, grazing management, and needed research; cultural resources management--cultural resource surveys, archeological site management, historic site management, contemporary native American concerns, collections management, and needed research.

Road Safety and Maintenance. Most through-highways and many access roads for developed areas within the recreation area are deteriorating and are chronic maintenance problems. Several roads commonly have more than 20 accidents per year and are consistent safety hazards. These problems need attention, but they are being solved in another planning process being done in conjunction with the Federal Highway Administration. Accordingly these issues will only be summarized and not solved in the GMP.

## LIST OF AGENCIES AND ORGANIZATIONS TO WHOM COPIES OF THE STATEMENT WERE SENT OR DISTRIBUTED

### Federal Agencies

Advisory Council on Historic Preservation
Department of Agriculture
    Forest Service
    Soil Conservation Service
Department of Defense
    Department of the Army
        Corps of Engineers
    U.S. Air Force
    Coast Guard
Department of Energy
    Federal Energy Regulatory Commission
Department of the Interior
    Bureau of Land Management
    Bureau of Mines
    Bureau of Reclamation
    Fish and Wildlife Service
        National Fish Hatchery
    Geological Survey
    Mining & Minerals Service
    National Park Service
Department of Transportation
    Federal Highways Administration
Environmental Protection Agency
Federal Emergency Management Agency

### State, Local, and Other Agencies

Arizona Dept. of Transportation
Arizona Game and Fish
Arizona Governor
Arizona Office of Economic Planning and Development (clearinghouse)
Arizona Office of Tourism
Arizona State Historic Preservation Office
Boulder City Mayor
Bullhead City Library
Bunkerville Town Board
Citizens Utility Co.
City of Las Vegas
Clark County Board of Commissioners
Clark County Department of Comprehensive Planning
Coachella Valley Water District
Colorado River Board of California
Department of Boating and Waterways (California)
Grand Canyon National Park
Lake Havasu City
Lake Havasu State Park
Las Vegas Convention/Visitors Authority

Las Vegas Mayor
Mesquite Town Board
Moapa Valley Town Board
Mohave County Planning and Zoning
Nevada Department of Transportation
Nevada Department of Wildlife
Nevada Division of Forestry
Nevada Division of State Parks
Nevada Governor
Nevada Magazine
Nevada State Clearinghouse Program
Nevada State Historic Preservation Office
Nevada State Planning Coordinator
Phoenix Public Library
San Diego Public Library
Searchlight Town Advisory Board
Southern California Edison
Tonto National Forest
Upper Colorado River Commission
Utah Department of Natural Resources
Valley of Fire State Park

Tribes and Local Governments

Chemehuevi Tribe
Colorado River Indian Tribes
Fort Mojave Indian Tribe
Hualapai Tribal Council
Kaibab Band of Paiute Indians
Pahrump Valley Paiute
Paiute Indian Tribe of Utah

Organizations

AORCC
Arizona Center for Law
Arizona Daily Sun
Arizona Natural Heritage Program
Arizona Republic
Boulder City News
Chambers of Commerce:
    Boulder City
    Henderson
    Kingman
    Las Vegas
    Virgin Valley
Desert Dispatch
Eagle Standard
Katherine Cabin Sites Association
Kingman Daily Miner
Lake Havasu City Herald
Las Vegas Review Journal

Las Vegas Sierra Club
Las Vegas Sun
Las Vegas Tribal Council
Meadview Civic Association, Inc.
Moapa Business Council
Mohave Valley News
National Parks & Conservation Assoc.
National Wildlife Federation
Nevada Appeal
Nevada State Journal/Gazette
Radio and TV Stations

| | | |
|---|---|---|
| Community Cable | KFSE | KORK |
| KAAA | KLAS | KRAM |
| KBAS | KLAV | KRRI |
| KCLS | KLUC | KTNV |
| KDWN | KLVX | KVBC |
| KELK | KNPR | KVEG |
| KELY | KOLO | KVVU |
| KENO | KONE | |
| KFMS | | |

Red Rock Audubon Society
San Diego Union
Sierra Club, Legal Defense Fund
Sierra Club, South Chapter
Temple Bar Leaseholders Association
University of
- Arizona
- Nevada, Las Vegas
- New Mexico
- Northern Colorado
- Southern California

Valley Herald and Lake Mead Monitor
Washington County News
Western Archeological and Conservation Center Library

Individuals

Approximately 280 individuals.

# APPENDIXES
# BIBLIOGRAPHY
# LIST OF PREPARERS
# INDEX

Public Law 88-639
88th Congress, S. 653
October 8, 1964

# An Act

78 STAT. 1039.

To provide an adequate basis for administration of the Lake Mead National Recreation Area, Arizona and Nevada, and for other purposes.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That, in recognition of the national significance of the Lake Mead National Recreation Area, in the States of Arizona and Nevada, and in order to establish a more adequate basis for effective administration of such area for the public benefit, the Secretary of the Interior hereafter may exercise the functions and carry out the activities prescribed by this Act. Lake Mead National Recreation Area. Administration.

SEC. 2. Lake Mead National Recreation Area shall comprise that particular land and water area which is shown on a certain map, identified as "boundary map, RA-LM-7060-13, revised July 17, 1963", which is on file and which shall be available for public inspection in the office of the National Park Service of the Department of the Interior. An exact copy of such map shall be filed with the Federal Register within thirty days following the approval of this Act, and an exact copy thereof shall be available also for public inspection in the headquarters office of the superintendent of the said Lake Mead National Recreation Area. Boundaries. Filing with Federal Register.

The Secretary of the Interior is authorized to revise the boundaries of such national recreation area, subject to the requirement that the total acreage of that area, as revised, shall be no greater than the present acreage thereof. In the event of such boundary revision, maps of the recreation area, as revised, shall be prepared by the Department of the Interior, and shall be filed in the same manner, and shall be available for public inspection also in accordance with the aforesaid procedures and requirements relating to the filing and availability of maps. The Secretary may accept donations of land and interests in land within the exterior boundaries of such area, or such property may be procured by the Secretary in such manner as he shall consider to be in the public interest. Boundary revision. Donations of land.

In exercising his authority to acquire property by exchange, the Secretary may accept title to any non-Federal property located within the boundaries of the recreation area and convey to the grantor of such property any federally owned property under the jurisdiction of the Secretary, notwithstanding any other provision of law. The properties so exchanged shall be approximately equal in fair market value: *Provided*, That the Secretary may accept cash from or pay cash to the grantor in such an exchange in order to equalize the values of the properties exchanged. Property acquisition.

Establishment or revision of the boundaries of the said national recreation area, as herein prescribed, shall not affect adversely any valid rights in the area, nor shall it affect the validity of withdrawals heretofore made for reclamation or power purposes. All lands in the recreation area which have been withdrawn or acquired by the United States for reclamation purposes shall remain subject to the primary use thereof for reclamation and power purposes so long as they are withdrawn or needed for such purposes. There shall be excluded from the said national recreation area by the Secretary of the Interior any property for management or protection by the Bureau of Reclamation, which would be subject otherwise to inclusion in the said recreation area, and which the Secretary of the Interior considers in the national interest should be excluded therefrom. Property exclusion.

SEC. 3. The authorities granted by this Act shall be subject to the following exceptions and qualifications when exercised with respect Hualapai Indian lands.

to any tribal or allotted lands of the Hualapai Indians that may be included within the exterior boundaries of the Lake Mead National Recreation Area:

(a) The inclusion of Indian lands within the exterior boundaries of the area shall not be effective until approved by the Hualapai Tribal Council.

(b) Mineral developments or use of the Indian lands shall be permitted only in accordance with the laws that relate to Indian lands.

(c) Leases and permits for general recreational use, business sites, home sites, vacation cabin sites, and grazing shall be executed in accordance with the laws relating to leases of Indian lands, provided that all development and improvement leases so granted shall conform to the development program and standards prescribed for the Lake Mead National Recreation Area.

(d) Nothing in this Act shall deprive the members of the Hualapai Tribe of hunting and fishing privileges presently exercised by them, nor diminish those rights and privileges of that part of the reservation which is included in the Lake Mead Recreation Area.

Recreational purposes.

SEC. 4. (a) Lake Mead National Recreation Area shall be administered by the Secretary of the Interior for general purposes of public recreation, benefit, and use, and in a manner that will preserve, develop, and enhance, so far as practicable, the recreation potential, and in a manner that will preserve the scenic, historic, scientific, and other important features of the area, consistently with applicable reservations and limitations relating to such area and with other authorized uses of the lands and properties within such area.

Activities.

(b) In carrying out the functions prescribed by this Act, in addition to other related activities that may be permitted hereunder, the Secretary may provide for the following activities, subject to such limitations, conditions, or regulations as he may prescribe, and to such extent as will not be inconsistent with either the recreational use or the primary use of that portion of the area heretofore withdrawn for reclamation purposes:

(1) General recreation use, such as bathing, boating, camping, and picnicking;

(2) Grazing;

(3) Mineral leasing;

(4) Vacation cabin site use, in accordance with existing policies of the Department of the Interior relating to such use, or as such policies may be revised hereafter by the Secretary.

Hunting, fishing, trapping.

SEC. 5. The Secretary of the Interior shall permit hunting, fishing, and trapping on the lands and waters under his jurisdiction within the recreation area in accordance with the applicable laws and regulations of the United States and the respective States: *Provided*. That the Secretary, after consultation with the respective State fish and game commissions, may issue regulations designating zones where and establishing periods when no hunting, fishing, or trapping shall be permitted for reasons of public safety, administration, or public use and enjoyment.

Regulations.

SEC. 6. Such national recreation area shall continue to be administered in accordance with regulations heretofore issued by the Secretary of the Interior relating to such areas, and the Secretary may revise such regulations or issue new regulations to carry out the purposes of this Act. In his administration and regulation of the area, the Secretary shall exercise authority, subject to the provisions and limitations of this Act, comparable to his general administrative authority relating to areas of the national park system.

The superintendent, caretakers, officers, or rangers of such recreation area are authorized to make arrests for violation of any of the regulations applicable to the area or prescribed pursuant to this Act, and they may bring the offender before the nearest commissioner, judge, or court of the United States having jurisdiction in the premises. Arrests.

Any person who violates a rule or regulation issued pursuant to this Act shall be guilty of a misdemeanor, and may be punished by a fine of not more than $500, or by imprisonment not exceeding six months, or by both such fine and imprisonment. Violations.

SEC. 7. Nothing in this Act shall deprive any State, or any political subdivision thereof, of its civil and criminal jurisdiction over the lands within the said national recreation area, or of its rights to tax persons, corporations, franchises, or property on the lands included in such area. Nothing in this Act shall modify or otherwise affect the existing jurisdiction of the Hualapai Tribe or alter the status of individual Hualapai Indians within that part of the Hualapai Indian Reservation included in said Lake Mead National Recreation Area. Jurisdiction.

SEC. 8. Revenues and fees obtained by the United States from operation of the national recreation area shall be subject to the same statutory provisions concerning the disposition thereof as are similar revenues collected in areas of the national park system with the exception that those particular revenues and fees including those from mineral developments, which the Secretary of the Interior finds are reasonably attributable to Indian lands shall be paid to the Indian owner of the land, and with the further exception that other fees and revenues obtained from mineral development and from activities under other public land laws within the recreation area shall be disposed of in accordance with the provisions of the applicable laws. Revenues and fees.

SEC. 9. A United States commissioner shall be appointed for that portion of the Lake Mead National Recreation Area that is situated in Mohave County, Arizona. Such commissioner shall be appointed by the United States district court having jurisdiction thereover, and the commissioner shall serve as directed by such court, as well as pursuant to, and within the limits of, the authority of said court. Mohave County, Ariz. Appointment of commissioner.

The functions of such commissioner shall include the trial and sentencing of persons committing petty offenses, as defined in title 18, section 1, United States Code: *Provided*, That any person charged with a petty offense may elect to be tried in the district court of the United States, and the commissioner shall apprise the defendant of his right to make such election, but shall not proceed to try the case unless the defendant, after being so apprised, signs a written consent to be tried before the commissioner. The exercise of additional functions by the commissioner shall be consistent with and be carried out in accordance with the authority, laws, and regulations, of general application to United States commissioners. The provisions of title 18, section 3402, of the United States Code, and the rules of procedure and practice prescribed by the Supreme Court pursuant thereto, shall apply to all cases handled by such commissioner. The probation laws shall be 62 Stat. 831. Probation laws.

applicable to persons tried by the commissioner and he shall have power to grant probation. The commissioner shall receive the fees, and none other, provided by law for like or similar services.

Appropriation.

SEC. 10. There are hereby authorized to be appropriated not more than $1,200,000 for the acquisition of land and interests in land pursuant to section 2 of this Act.

Approved October 8, 1964.

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LEGISLATIVE HISTORY:

HOUSE REPORT No. 1039 accompanying H. R. 4010 (Comm. on Interior & Insular Affairs).
SENATE REPORT No. 380 (Comm. on Interior & Insular Affairs).
CONGRESSIONAL RECORD:
Vol. 109 (1963): Aug. 2, considered and passed Senate.
Vol. 110 (1964): Aug. 3, considered and passed House, amended, in lieu of H. R. 4010.
Sept. 28, Senate concurred in House amendment.

GPO 35-139

United States Department of the Interio
NATIONAL PARK SERVICE
WESTERN REGION
450 GOLDEN GATE AVENUE, BOX 36063
SAN FRANCISCO, CALIFORNIA 94102

IN REPLY REFER TO:

N1621(WR-PPA)

February 24, 1983

Memorandum

To: Regional Director, U.S. Fish and Wildlife Service, Albuquerque, New Mexico

From: ACTING Regional Director, Western Region

Reference: Lake Mead National Recreation Area, General Management Plan/Land Protection Plan, Environmental Impact Statement

Subject: Formal Consultation Pursuant to Section 7, Endangered Species Act

A planning team composed of members from the Denver Service Center and Lake Mead National Recreation Area is preparing a general management plan, a land protection plan and environmental impact statement for Lake Mead. The plan encompasses actions throughout the recreation area with primary emphasis around established developed or visitor use areas. Per this memorandum we would like to initiate consultation with your office and request an endangered species list covering areas in your jurisdiction within the recreation area. A similar request is being made of your Portland, Oregon office for the portions of Lake Mead in Nevada. We would also be interested in any comments or concerns you may have at this time. The information received from you will be considered during our planning process and we will provide you with draft copies of documents for review when they become available.

Contacts regarding this consultation can be made with Terry Goodrich, National Park Service, 755 Parfet Street, P.O. Box 25287, Denver, Colorado 80225, FTS telephone 234-4509. A timely response to this request would be greatly appreciated since we are working under a very tight schedule. Please advise us which Regional Office and/or area offices will have the responsibility for coordinating this consultation.

(Sgd) John D. Cherry

Enclosure

cc:
Supt., Lake Mead w/o enc.
Assistant Manager, Alaska, PNW/Western Team, DSC w/o enc.

# United States Department of the Interior

**FISH AND WILDLIFE SERVICE**
GREAT BASIN COMPLEX OFFICE
4600 Kietzke Lane - Bldg. C
Reno, Nevada 89502-5093


April 8, 1983

File No.: 1-5-83-SP-16

Mr. Terry Goodrich
National Park Service
755 Parfet Street
P. O. Box 25287
Denver, CO 80225

Dear Mr. Goodrich:

As requested by N1621 (WR-PPA), dated February 23, 1983, you will find attached a list of the listed and proposed endangered and threatened species (Attachment A) that are present or may be present in the area of the proposed Lake Mead General Management Plan. The list is intended to fulfill the requirement of the Fish and Wildlife Service to provide a list of species under Section 7(c) of the Endangered Species Act of 1973, as amended. Please see Attachment B for your requirements.

Also, for your assistance we have included a list of candidate species that are present or may be present within the project area. These species are presently being reviewed by this Service for consideration to propose and list as endangered or threatened. It should be noted that candidate species have no protection under the Endangered Species Act and are included for your consideration as it is possible these could become formal proposals and be listed during the construction period.

Upon completion of the Biological Assessment (see Attachment B), should you determine that a listed species is likely to be affected (adversely or beneficially), then your agency should request formal Section 7 consultation through this office. If there are both listed and proposed species (or candidate species, if included in the assessment) that may be affected; then we will confer on the proposed species (and/or informally consult on the candidate species) during the formal consultation. However, should the assessment reveal that only proposed species (or candidate species) may be affected, then you should consider informal consultation with this office.

One of the benefits of informal consultation to the consulting agency is to provide the necessary planning alternatives should a proposed (or candidate) species become listed before completion of a project.

Should you have any additional questions regarding your responsibilities under the Act, please contact this office. We thank you for your interest in endangered species, and we await your Biological Assessment.

Sincerely yours,

Donald J. King
Complex Manager

Attachments:

cc: Regional Director (AFA-SE)
GBC Files
Boise FO

General Management Plan
Land Protection Plan
for
Lake Mead National Recreation Area
Mohave County, Arizona

## LISTED SPECIES

| | | |
|---|---|---|
| Bonytail chub (Endangered) | *Gila elegans* | Historically found throughout mainstream of Colorado River and major tributaries in eddies and pools; Lake Mohave contains the only universally recognized pure population. |
| Bald Eagle | *Haliaeetus leucocephalus* | A winter resident of Lake Mead; found along shorelines. |

## PROPOSED SPECIES

None

## CRITICAL HABITAT

None

## CANDIDATE SPECIES

| | | |
|---|---|---|
| Mammals | | |
| Spotted bat | *Euderma maculatum* | Found throughout Arizona in rocky cliffs and canyons. Rare in Lake Mead Recreation Area. |
| Fishes | | |
| Razorback sucker | *Xyrauchen texanus* | Historically found throughout mainstream of Colorado River and major tributaries; Lake Mohave contains one of the largest populations known. |

| | | |
|---|---|---|
| Birds | | |
| White-faced ibis | Plegadis chihi | A fairly common to uncommon transient visitant along major water courses in Arizona. |
| Swainson's hawk | Buteo swainsoni | A transient in western Arizona; feeds on gophers and grasshoppers; Rare. |
| Ferruginous hawk | Buteo regalis | An uncommon resident of grassy plains of northern Arizona, more often seen as a winter visitor; feeds entirely on rodents. |
| Western snowy plover | Charadrius alexandrinus nivosus | A rare transient visitant along lower Colorado River, found along sandy or alkaline shores, riverbanks, and mudflats. |
| Mountain plover | Charadrius montanus | A transient, rarely breeding, in western Arizona found along grassy mesas, desert flats, or fallow fields. (one observation in LMRA) |
| Long-billed curlew | Numenius americanus | A rare transient visitant throughout Arizona found along marshes, mudflats, and beaches. |
| Western yellow-billed cuckoo | Coccyzus americanus occidentalis | Breeds in extreme northwest Arizona and a transient along wooded streams and in towns; Rare summer visitant. |
| Reptiles | | |
| Desert tortoise | Scaptochelys agassizii | Found in Sonoran and Mohave deserts along rocky hillsides and washes. |
| Gila monster | Heloderma suspectum | Found in arid and semi-arid areas particularly desert flats, nearby canyons, and washes. Between Echo Bay and Overton near Katherine's Landing by Davis Dam. |

| | | |
|---|---|---|
| Plants | *Camissonia exilis* | Known for the eastern base of Virgin Mountains on gypsum covered flats at 3,500 feet elevation. |
| | *Eriogonum thompsonae* | Found in Mohave County on red clay hills, Great Basin sagebrush and along highway right-of-way. |
| Sticky buckwheat | *Eriogonum viscidulum* | Limited in distribution to area of Riverside near Virgin River, Clark County, NV or washes and flats in sandy soil. |
| | *Perityle megalocephala* var. *intricata* | Associated with shadscale near Overton Beach; on NNNPS Watch List. |
| Golden bear poppy | *Arctomecon californica* | Occurs near Las Vegas Wash and Boulder Beach on barren, gravelly desert flats, hummocks and slopes associated with gypsum soils. Also near Stewart Point. |
| Bicolored penstemon | *Penstemon bicolor* ssp. *roseus* | Near Las Vegas Wash on slight elevations, in shallow gravelly washes, roadsides (possible taxonomic problems) |

# FEDERAL AGENCIES' REQUIREMENTS UNDER SECTION 7(c)

## Biological Assessments

This process is initiated by a Federal agency in requesting a list of proposed and listed endangered and threatened species that may be within the area of a construction project.[1/] The purpose of the assessment is to identify any proposed and/or listed species which are/is likely to be affected by a construction project. When present in the project area, proposed species are included on the list even though they do not have legal protection under the Act. Their inclusion recognizes that they may be listed at anytime and have the portent to cause delays or modifications to the proposed action. In light of this, we recommend that those species be included in the biological assessment. The assessment should be completed within 180 days after initiation of the assessment (or within such a time period as is mutually agreed to by our two agencies). The assessment should begin within 90 days after receipt of the species list or a new list should be requested. No irreversible commitment of resources is to be made during the biological assessment process which would result in violation of your requirement under Section 7(a) of the Act. Planning, design, and administrative actions may be taken by your agency; however, no construction may begin.

Your agency should conduct an on-site inspection of the area to be affected by the proposal which may include a detailed survey of the area to determine if the species is present and whether suitable habitat exists for either expanding the existing population or for potential reintroduction of the species. Review literature and scientific data to determine species distribution, habitat needs, and other biological requirements. Interview experts including those within Fish and Wildlife Service, National Marine Fisheries Service, State conservation departments, universities and others who may have data not yet published in scientific literature. Review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat. Analyze alternative actions that may provide conservation measures. At the conclusion of the assessment as described above, the Federal agency shall prepare a report documenting the results. The report shall also include a discussion of study methods used, any problems encountered, and other relevant information. The report should be forwarded to this office.

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1/ "Construction Project" means any major Federal Action which significantly affects the quality of the human environment designed primarily to result in the building or erection of man-made structures such as dams, buildings, roads, pipelines, channels, and the like. This includes Federal actions such as permits, grants, licenses, or other forms of Federal authorization or approval which may result in construction.

# APPENDIX C: CULTURAL RESOURCE CONSULTATIONS

In accordance with the September 1981 revision to the 1979 programmatic memorandum of agreement between the National Park Service, the Advisory Council on Historic Preservation, and the National Council of State Historic Preservation Officers, the National Park Service has requested the advice and consultation of the Advisory Council and the Nevada and Arizona state historic preservation officers during preparation of this plan. A formal letter indicating that the planning effort was underway and a request for their participation was sent to those three offices on May 13, 1982, along with a list of planning issues. Subsequently, the results of the issues survey was sent to both state historic preservation officers and the Advisory Council in July 1982, and the planning alternatives workbook was submitted for their review and comment in December 1982. The Advisory Council has also attended planning sessions for the general management plan in April, July, and October 1982, and January 1983. The advice and consultation of these offices will continue to be requested as the plan progresses. Review copies of the draft plan will be submitted for comment, and they will be invited to attend all future public meetings.

In February and March 1982, a National Park Service anthropologist conducted preliminary consultations with nine native American groups representing the Mohave, Hualapai, and Chemehuevi/Southern Paiute tribes. These consultations were initiated with the purpose of identifying the locations of any sacred sites within Lake Mead, and of ascertaining any special concerns the native Americans wished to express during the planning process. The results of these consultations were relayed to both the recreation area staff and the planning team, and the native American groups were included on the mailing list for the plan, to ensure them an opportunity to attend all public meetings, and to review and comment on all public information documents released throughout the life of the plan.

**Advisory Council On Historic Preservation**

1522 K Street, NW
Washington, DC 20005

Reply to:

Lake Plaza South, Suite 616
44 Union Boulevard
Lakewood, CO 80228

PLEASE NOTE CHANGE IN ADDRESS

730 Simms Street, Room 450
Golden, Colorado 80401

December 20, 1982

Mr. Kenneth Raithel, Jr.
Assistant Manager
Alaska/Pacific Northwest/Western Team
Denver Service Center
National Park Service
P.O. Box 25287
Denver, CO 80225

Dear Mr. Raithel:

On December 13, 1982, we received the review copy of "Planning Alternatives Workbook" for Lake Mead National Recreation Area, Arizona/Nevada and your letter requesting our informal review of the document pursuant to the Programmatic Memorandum of Agreement ratified by the Chairman September 1981. After reading this document and discussing certain points with Dr. Latschar, we find that we have no comments to offer at this time.

Thank you for the opportunity to examine the "Planning Alternatives Workbook".

Sincerely,

Louis S. Wall
Chief, Western Division
of Project Review

## APPENDIX D: COOPERATIVE AGREEMENTS

The National Park Service (NPS) is under contract to place utilities underground and update all the existing power system at Boulder Beach to allow the Nevada Power Company to maintain the system and to provide the required power. When Nevada Power Company takes over the new system, the National Park Service will release 500 kw of firm energy entitlement to the Western Area Power Administration (WAPA).

The memorandum of understanding between the Bureau of Reclamation and National Park Service, related to land leased by the Bureau of Reclamation to the Nevada Division of Colorado River Resources, provides authorization to operate the Southern Nevada Water Project.

The memorandum of understanding between the National Park Service and the Nevada Department of Fish and Game (July 1971) defines individual responsibilities for the management of fish and wildlife resources within units of the national park system in Nevada. This agreement provides that the National Park Service will consult with and obtain concurrence from the state's fish and game department about programs that significantly affect fish and wildlife resources and cooperate in the joint enforcement of hunting, fishing, and boating laws. The department will consult with the National Park Service before establishing fishing and hunting seasons and regulations affecting NPS areas. The two agencies will meet annually to discuss matters of mutual interest. A similar agreeement is being pursued with the Arizona Department of Fish and Game.

A supplemental agreement of August 1971 was granted to the Nevada Department of Wildlife for exclusive use of lands to be used for construction and operation of a fish hatchery within lake Mead National Recreation Area for a period of 99 years. Fish reared in the hatchery are planted for recreational purposes in Lakes Mead and Mohave.

There is a supplemental memorandum of understanding of 1975 with the Nevada Department of Fish and Game to work cooperatively on a bighorn sheep trapping and management program.

A memorandum of understanding between the Bureau of Reclamation, National Park Service, and U.S. Fish and Wildlife Service (FWS) provided an area at Willow Beach for the use and occupancy by FWS for construction, operation, and maintenance of a fish cultural station. Fish reared in this hatchery are planted in Lake Mohave and in the lower Colorado River.

A memorandum of agreement between the National Park Service, Bureau of Reclamation, and the state of Nevada, related to leasing wildlife managements in Lake Mead National Recreation Area (July 1978), resulted in the leasing of the Overton Wildlife Management Area to the state of Nevada for 25 years. This area provides nesting habitat for waterfowl and recreational hunting opportunities.

The cooperative firefighting agreement between the Bureau of Land Management (BLM) and National Park Service (October 1975) provides for cooperative assistance in wildland firefighting activities. The principal assistance is rendered in the Shivwits Plateau area. BLM personnel are more capable of initial attack on fires in area.

In April 1972, a memorandum of understanding between the Bureau of Land Management, Bureau of Reclamation, and the National Park Service about grazing provides that grazing within Lake Mead will be administered by the Bureau of Land Management in accordance with the act of October 8, 1964. Fees collected will be deposited in accordance with BLM requirements.

A basic agreement between Lake Mead and the American Federation of Government Employees, Local 3062, grants exclusive recognition to the union to represent maintenance personnel and to provide and promote the efficient administration of Lake Mead.

A mutual aid agreement between Lake Mead and Boulder City (June 1975) provides for fire suppression and ambulance service in the Boulder Beach area.

Lake Mead and Bullhead City have a mutual aid agreement (January 1977) that provides for fire suppression in the Katherine area.

There is a letter of agreement with the Clark County Department of Building and Safety to inspect new construction of public structures occurring within Lake Mead National Recreation Area.

## APPENDIX E: GLOSSARY OF PLANNING TERMS

| | |
|---|---|
| Access Point | A location where vehicular access to the water is provided |
| Carrying Capacity | The population that an area will support without undergoing significant deterioration. In this document, carrying capacity has been further defined by the Lake Mead Carrying Capacity Study as "the maximum number of boats which can be accommodated at one time in each zone of the lake" (USDI 1980). This study defined physical carrying capacity only. Social variables that would determine the social carrying capacity of the lake or the maximum number of visitors who could be on the lake, without the visitor's experience deteriorating, have not been determined as of yet |
| Courtesy Docks | Docks provided for such temporary use (normally 15 minute zone) as stops to get ice and snacks |
| Day Use Activities | Activities (boating, picnicking, swimming) that visitors participate in for the day only |
| Designated Swim Beach | Swimming areas that are staffed by lifeguards; currently available at Boulder Beach and Katherine |
| Destination Resort/Area | A resort or development that offers a full range of services to visitors who may be a considerable distance away from their homes and/or plan to stay at the resort overnight or for an extended time |
| Developed Areas | Areas that contain visitor services and facilities (areas with only restrooms, launch ramps, and roads are not considered developed) |
| Development Concept Plan | A plan that defines specific kinds, sizes, and locations of park developments and facilities |
| Flat-Wake Zones | Buoyed-off areas with low-speed requirements for watercraft (5 m.p.h.) |
| Flood Mitigation | Actions that eliminate flooding or make the effects of flooding less severe |
| Structural Flood Mitigation | Flood mitigation measures that involve major construction, such as dams, channels, diversions, or flood walls |

| | |
|---|---|
| Nonstructural Flood Mitigation | The most feasible combination of flood mitigation measures that do not involve major construction - relocation, warning systems, evacuation plans, closures, information, etc. |
| Floodplain | Land that may be submerged by flood waters |
| Full Service | The highest or greatest degree of development where a complete range of services is offered |
| General Management Plan | A parkwide plan for meeting park management objectives; it divides the park according to future management emphasis and presents short-term and long-range strategies for resource management, visitor use, and park development |
| Improved Access Point | Improvements that consist of upgrading the quality of gravel/dirt roads that lead to the water so that most vehicles are accommodated, providing a concrete two or three lane launch ramp, primitive camping area, graded parking, and about ¼ mile of dirt road above high water paralleling the shoreline for access to the shoreline |
| Improved Road | A road that is upgraded through widening or realigning of curves |
| Long-Term Trailer Site | A trailer site that may be occupied for more than 30 days within a year |
| Major New Development | A development that offers a full range of visitor services and facilities to accommodate many people; these developments will be phased in gradually, in response to public demand and park funding priorities |
| Primitive Access | Dirt roads that four-wheel-drive vehicles usually use for access to the water |
| Primitive Campground | Campsites having no amenities, such as water, restrooms, picnic tables, or grills |
| Ready Lane | A lane that is usually striped on the launch ramp, which is used to prepare a boat for launching so that boating activities do not tie up the launching area; it is also used for unloading boats after being removed from the water |
| Rehabilitation | Restoration of a structure or area to a condition of greater usefulness |

| | |
|---|---|
| Relocation | Moving to a new location within the same developed area, unless otherwise specified |
| Restrooms | Facilities that may range from pit or chemical toilets to flush toilets and sinks |
| Short-Term Trailer Site | A trailer site that may only be occupied for less than 30 days within a year |

## APPENDIX F: OTHER FLOOD MITIGATION METHODS CONSIDERED

The following discussion summarizes those additional flood mitigation methods that were considered for each developed area and the reasons they were rejected.

Katherine - Several different methods of channeling flows and lining the channels were investigated, but all were rejected because of high cost ($1-8 million).

Cottonwood Cove - One additional structural mitigation method was investigated, which consisted of a network of dams and diversion channels placed in or above the development. This alternative was rejected because of high cost ($20 million).

Willow Beach - A series of detention dams, diversion dams, diversion canals, and channeling was investigated in 1979 for 100-year flood protection. Costs for implementing these measures were in excess of $40 million. These measures were reevaluated in October 1980 for protection against the probable maximum flood and again found to be infeasible. At that time additional diversion measures suggested by the public were investigated but were also found to be infeasible. All of the above solutions were rejected because of high cost.

Las Vegas Wash - Additional structural methods investigated included channeling of flow around the dry boat storage and boat launch areas, channeling around the dry boat storage area only, and protection of the entire area with an earthen dam above the highway. These methods ranged in cost from $0.5-1 million. Because all methods were more expensive than relocation, they were rejected.

Overton - No structural measures were investigated.

Temple Bar - Additional channeling through the area was investigated to protect the dry boat storage area, but relocation was less expensive.

# AN EVALUATION OF MINERAL RESOURCES
# LAKE MEAD NATIONAL RECREATION AREA
# ARIZONA AND NEVADA

Robert O'Brien
Professional Mining Engineer
Registered State Washington 8800

PURPOSE:

The purpose of this assessment of the occurrence and significance of minerals in Lake Mead National Recreation Area is to set forth in a useable format the mineral resource data necessary to guide the planning, development and management of the Lake Mead National Recreation Area.

DEFINITIONS:

In correlating, assessing, and evaluating the considerable number of U.S. Geological Survey, Nevada Bureau of Mines, Arizona Bureau of Mines and other professional source data covering the mineral resources of southeastern Nevada and northwestern Arizona, it was found necessary to utilize a generally acceptable measure for mineral resource estimating--one that would adequately define mineral resource terminology. The Department of Interior News Release headed: "Office of the Secretary, for release April 15, 1974, entitled, 'New Mineral Resource Terminology Adopted,'" has been used as common reference point and "measuring stick" in the following summary of such source data.

The definitions covered in the Secretary's release were particularly directed for the use of the Bureau of Mines and the Geological Survey in their assessment of the nation's mineral resources. The more essential definitions used to bring available source data "into focus" in the preparation of this evaluation, follow:

"Mineral Resources - Are defined as concentrations of naturally occurring solids, liquids, or gases, discovered or only surmized that are or might become economic sources of mineral raw materials."

"Mineral Reserves - Are that portion of mineral resources that have actually been identified, and can be legally and economically extracted."

"Identified-Subeconomic Resources - Known deposits not now mineable economically."

"Submarginal - The portion of subeconomic resources which would require a substantially higher price or a major cost reducing advance in technology.

"Speculative Resources - Undiscovered materials that may occur either in known types of deposits in a favorable geologic setting where no discoveries have been made, or in as yet unknown types of deposits that remain to be recognized."

MINERAL RESOURCES, LAKE MEAD NATIONAL RECREATION AREA

Mineral resources will be subdivided, for the purpose of this assessment as handled by the U. S. Geological Survey, The Arizona (State) Bureau of Mines, and the Nevada (State) Bureau of Mines, into metallics, non-metallics, and energy. Uranium, a metallic mineral will be handled under energy, if worthy of mention. The categories in which those identified minerals are placed is my best judgement at this time.

METALLIC RESOURCES

GOLD - Gold in lode deposits has been found in several locations along the westside of Lake Mohave in the Newberry Mountains and the Eldorado Mountains in Nevada and near Davis Dam in Arizona.[1] These deposits are identified on the map accompanying this report. Free milling gold and silver were mined in association with oxides of copper, lead and zinc. The references to these mining districts were written in 1960, but the period of greatest production occurred prior to 1940. When the mines reached depths below the oxidation zone the veins apparently became barren or lensed out.

A portion of the Gold Butte Mining District extends South into T21S, R70E. which is within Lake Mead National Recreation Area.[2] Only the Lake Shore Mine in Section 5, T21S, R70E has had any recorded production and that was prior to 1940.

There has been no successful placer gold mining with the boundaries of Lake Mead National Recreation Area. In 1967 under the Heavy Metals Program the U.S. Geological Survey identified, examined and sampled placer deposits in Gold Basin and Lost Basin. To the best of my knowledge these areas are outside the Recreation Area.

The lode gold-silver mines are, in my opinion, worked out. Periods of high prices bring periods of increased prospecting. Paradoxically, periods of hard times also bring spurts in the prospecting activity for gold and silver. Prices for gold and silver are adequate, at this time, for mine operations if there is ore in place. These minerals have been placed in a speculative category because new and better ore shoots must be found to begin production.

The placer gold deposits south of the Recreation Area have

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[1] See Area 1 on Index Map.

[2] See Area 2 on Index Map.

been placed in speculative category because of the marginal grade at this price ($400 per ounce) and because of the quantity of water needed to recover the gold. A placer gold operation would require approximately 60 gallons per minute for each cubic yard of production capacity.

MANGANESE

Low grade manganese ores are present in the Recreational Area[3] in the Black Mountains north of Lake Mead. These ores are sub-marginal in character in that they require a high degree of concentration to produce a product only partially acceptable in the market. These manganese deposits were mined in response to a U. S. Government buying and stockpiling program which terminated in approximately 1959. No mining has been done since that time.

There would have to be a substantial increase in price, and a substantial improvement in concentrating technology to make these ores attractive for production again. These improvements could happen if the foreign supply of manganese was cut off. Future operations, if any, would be open pit operations as they were when last operated.

MOLYBDENUM

Molybdenum has been reported in the Recreation Area around Capital Camp[4] in the Eldorado Mountains. These occurrences were drilled several years ago by Placer Amex Corporation and subsequently abandoned. Other reports of molybdenum deposits have not been substantiated.

Both of these rumored deposits can only be categorized as speculative since no orebody has been delineated. A molybdenum orebody is normally low grade 0.20% to 0.40% (4lbs. - 8lbs. per ton) and very large, in the range of 100,000 tons and more. Open pit would be the preferred mining procedure. Problems would entail water supply for a large mill in the 10,000 to 20,000 tons/day range with water needed at approximately 240 gallons/ton/day. Another problem would be tailings disposal. The ore at 8 lbs/ton would generate 1992 lbs of waste per ton.

NON-METALLIC RESOURCES

SILICA - Silica is being mined just outside the boundary of the Recreation Area near Overton, Nevada. There are no reported deposits within the Recreation Area.

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[3] See Index Map Area 3

[4] See Area No. 4 Index Map

SALT - Large deposits of salt were mined near St. Thomas wash and Overton Beach, prior to the completion of Boulder Dam in the 1930's. Those deposits were inundated by the creation of the Dam and mining ceased.

There are subsurface deposits of salt under both Detrital Valley and Hualapai Valley outside of the Recreation Area. Since those deposits are from 300 to 1200 feet below the surface, their actual extent has not been determined. Extraction of these salts would probably be accomplished by solution extraction and precipitation (evaporation). Solution extraction would consist of drilling wells into the salt and injecting a fluid (water), then pumping the solution out and to evaporation ponds. To get any sort of production, more than one well would have to be activated. Each well would require from 500 g.p.m., all or most of which would be lost in the evaporite ponds. Extractions from those deposits would only be a factor to visitors on an access road.

PUMICE - A deposit of pumice has been found in the River Mountaines west of Lake Mead. This deposit is not block pumice, but has been classified as a common variety. As a common variety mineral, this pumice is not subject to leasing and should be in a speculative category.

BASE METALS

Base metals such as lead, zinc, and copper have been mined at several locations on the west side of Lake Mohave up to within a few miles of Lake Mead.[5] The base minerals produced have generally been by-products (of lesser value) of gold and silver productions. Presence of known contemplated operations in this area give some indication of being more in the nature of promotional activities and therefore fall in the speculative-submarginal category. The operations have been for the most part outside of the boundary of the National Recreation Area.

There are a number of mineral leases and applications for mineral leases within Lake Mead National Recreation Area. The leases are an attempt to find ore of a value to produce (prospecting only). These leases can only be called speculative at this time.

Withdrawal from leasing of any mineral or area within Lake Mead National Recreation Area would have an impact only upon the individual attempting to obtain the lease.

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[5]See Map No. 2

In 1980, G. Thomas Server, Jr., James P. Calzia, and Barry J. Solomom identified the occurrence of minerals in the region of Lake Mead National Recreation Area in their publication, "A Summary of Mineral Occurrences in the Region of Lake Mead National Recreation Area." This publication was a Pre-Publication copy for Government Use Only. It should be noted that the two authors denote these as occurrences and do not indicate whether the minerals are or ever will be economical to produce. They should be placed in a speculative category.

ENERGY RESOURCES

OIL and GAS - The proliferation of oil and gas leases along the west side of Overton Arm in Nevada and along the east side of the Black Canyon and Lake Mohave leads one to speculate on the reasons for such interest. In Clark County, Nevada[6] thirteen holes have been drilled north of the Recreation Area and all have been abandon. Hole No. 62 is not within the Recreation Area, but is on the border. In Mohave County, Arizona[7 & 8] there have been no holes drilled for oil or gas within Lake Mead National Recreation Area.

Speculation apparently revolves around a deep hole (19, 562 feet) drilled in 1980 by the Mobil Oil Corporation. Reliable information on the results of that drilling is not available. Conjecture would point to a quest for stratigraphic information which could locate the trend of the Overthrust Belt. The Overthrust Belt is a region in northwest Utah, southwest Wyoming, and northwestern Colorado, which has been productive of oil and gas in the past five years. Production has been attained at depths below 13,000 feet, in general. Another look at this activity might have to be made when more information is available.

There are no known oil or gas fields within Lake Mead National Recreation Area. There have been no oil and gas wells drilled within the Recreation Area. This leasing activity within Lake Mead National Recreation Area falls into the speculative category.

URANIUM - Deposits of uranium either large or small have not been proven in the Lake Mead Recreation Area. The Copper Mountain Mine[9] on the East side of Andrus Canyon was mined

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[6] See Map No. 3

[7 & 8] See Maps No. 4 and No. 5

[9] See Area No. 5, Index Map

in the 1960s for copper. Uranium is suspected as a companion mineral with the copper, but has not been proven. There has been no record of production since the 1960's. Uranium mines or mining should be placed in a speculative category since no deposits have been identified to quantity or quality.

The market for uranium is down at this time. Quite a number of mines which were producers 4 or 5 years ago have closed. If and when the price goes up, there will certainly be mining companies and prospectors wanting to look at old mines and prospect for new mining possibilities. The majority of uranium mining operations in the Arizona area would be underground operations.

Uranium ores require concentration. There are only a few concentration plants available and these few are long distances from Northern Arizona. The economics of mining and then hauling crude ore long distances are not good unless the deposit is high grade. The nearest buying plant at this time for uranium ores is at Blanding, Utah. The economics of building a concentration plant in or close to the uranium deposits in Lake Mead National Recreation Area are not good due to the lack of volume for processing.

Future leases for uranium ores should consider carefully the problems of water usage and disposal, waste disposal and truck traffic.

SUMMARY

This report is a complete inventory and evaluation of the known mineral resources within the Lake Mead National Recreation Area. There are no minerals within the Recreation Area which are the sole supply or a major source of supply for the United States at this time. The greatest impact of a withdrawal from leasing of any mineral would be upon the individual attempting to get the lease.

If additional drilling near the Mobil Oil Company deep hole proves the existence of the Overthrust Belt in the area there will be pressures to drill along the West side of Overton Arm. While off-set drilling is possible, the drilling companies will be very reluctant to add that much additional drilling footage to an already very deep hole. It should be pointed out that the greatest impact on the environment of oil and gas production would happen during the drilling (exploration) phase.

The only minerals which could have relative importance to other values within Lake Mead National Recreation Area are oil and gas, and uranium, which are still in the speculative category. Manganese operations could also have a very remote possibility of causing problems, but only if five or six happenings coincided, such as: Cut off of foreign supplies, improvement in the uses of manganese in the steel furnaces, and exhaustion of current stockpiles.

CONCLUSIONS

* The inventory indicates no mineral reserves in the Lake Mead NRA.

* All possible mineral resources are classified as economically submarginal and geologically speculative, the lowest possible classification according to the USGS system.

* Any restriction on mineral exploration or mineral leasing, including the exception of any portion of Lake Mead NRA from mineral leasing can be expected to have no measurable impact on present or future production.

* Consideration of mineral values in secondary to other resource values in preparing the General Management Plan for the NRA.

Robert O'Brien

1/20/83

## SELECTED REFERENCES


(1) Arizona Bureau of Mines in conjunction with the U.S. Geological Survey and the U.S Bureau of Reclamation, 1969, Mineral and Water Resources of Arizona: Bulletin 180.

(2) Longwell, C. R., E. H. Pampeyan, Ben Bowyer, and R. J. Roberts, 1965, Geology and Mineral Deposits of Clark County, Nevada: Nevada Bureau of Mines Bulletin No. 62.

(3) Garside, Jarry J., and John H. Schilling, 1977, Wells Drilled for Oil and GAs in Nevada through 1976, Map No. 56: Nevada Bureau of Mines and Geology.

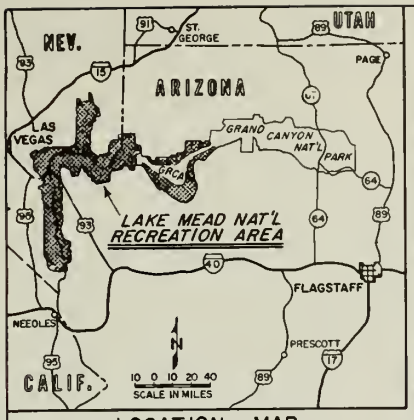
(4) _____, 1982, List of Wells Drilled for Oil and Gas. (Update to Map 56): Nevada Bureau of Mines and Geology.

(5) Conley, J. R., and O. A. Stacey, 1981, Well Location Map Four: Arizona (State) Oil and Gas Conservation Commission, October 1977, (Revised 1981)

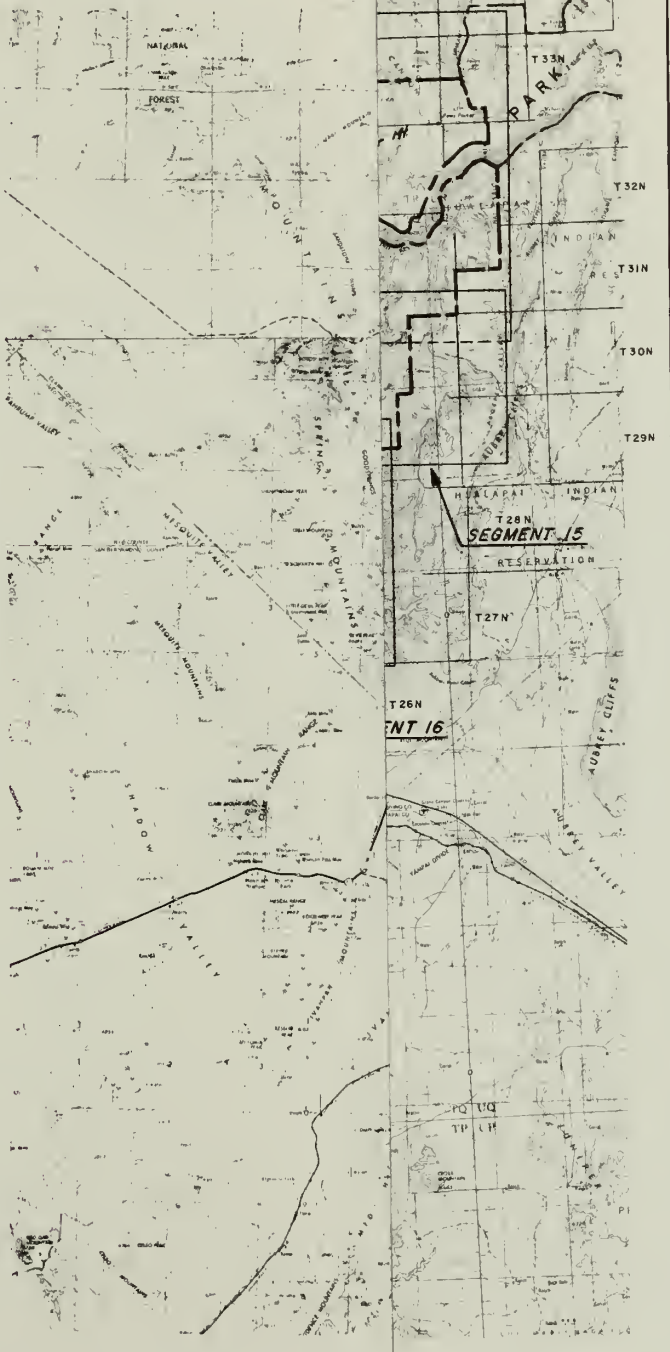
(6) Corrections and Additions to Table 2 of above Publication up to June 1982

(7) Swapp, Cloyd W., Geologist, 1961, The Geology and Gas and Oil Possibilities of Northwestern Arizona: Published by Arizona Board for the Arizona Oil and Gas Conservation Commission.

(8) G. Thomas Server, Jr., James P. Calzia, and Barry Solomon, 1980, A Summary of Mineral Occurrences in the Region of the Lake Mead National Recreation Area. Pre-publication copy, For Government Use Only.




LOCATION MAP

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UNITED STATES
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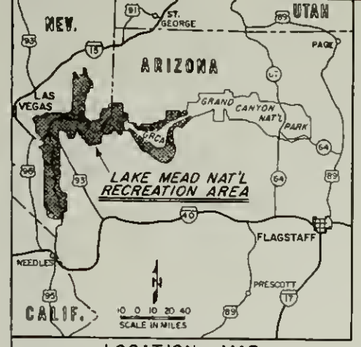
# LAKE MEAD NATIONAL RECREATION AREA

CLARK COUNTY, NEVADA
MOHAVE COUNTY, ARIZONA
Map No.1

TITLE
INDEX MAP




LOCATION MAP

SEGMENTS 19;20
SEGMENT 08
SEGMENT 07
SEGMENT 10
SEGMENT 14
SEGMENT 5
SEGMENT 12
SEGMENT 26
SEGMENT 4
SEGMENT 06
SEGMENT 09
SEGMENT 11
SEGMENT 15
SEGMENT 3
SEGMENT 13
SEGMENT 16
SEGMENTS 21-25,27 AND INDEX "B"
SEGMENT 18
SEGMENT 2
SEGMENT 1
SEGMENT 17

LAS VEGAS
GRAND CANYON
COLORADO RIVER INDIAN RESERVATION

| DEED | TRACT | OWNER | ACRES | INT |
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| DATE | REVISIONS | DATE | REVISIONS |
|---|---|---|---|
| | | | |

ESTABLISHED: OCTOBER 8, 1964

BOUNDARY CHANGE: JANUARY 3, 1975
BASIC DATA U.S.G.S. 15' QUADRANGLE
DATE: MAY 1975

COMPILED BY
DENVER SERVICE CENTER, COLORADO

MT. DIABLO MERIDIAN, NEVADA
GILA & SALT RIVER MERIDIAN, ARIZONA

5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 Kilometers
8,045 Kilometers = 5 Miles

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|---|---|---|---|---|---|
| 6 | 5 | 4 | 3 | 2 | 1 |
| 7 | 8 | 9 | 10 | 11 | 12 |
| 18 | 17 | 16 | 15 | 14 | 13 |
| 19 | 20 | 21 | 22 | 23 | 24 |
| 30 | 29 | 28 | 27 | 26 | 25 |
| 31 | 32 | 33 | 34 | 35 | 36 |

DN BY: DK CK BY: [illegible]
APPR BY: [illegible]
REGION WESTERN
DRAWING NO
8360
80,500
SHEET 1 OF 3D

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
DIVISION OF LAND ACQUISITION

# LAKE MEAD NATIONAL RECREATION AREA

CLARK COUNTY, NEVADA
MOHAVE COUNTY, ARIZONA
MSO No.!

TITLE
INDEX MAP

## EXPLANATION

Symbols show approximate location of principal minerals. Inactive mines are not shown unless known, and in the case of some of the mineral occurrences indicated. Multiple occurrences of the same mineral within small areas are not differentiated. Mines or prospects where the mineral is unknown are not noted.

An asterisk (*) denotes that the mineral occurs within the Lake Mead National Recreation Area. Other minerals occur in the region surrounding the N.R.A.

All minerals are leasable on federal acquired land and Indian land.

SCALE 1:250,000

### LEASABLE MINERALS

LANDS PROSPECTIVELY VALUABLE FOR RETENTION OF FEDERAL MINERAL RIGHTS

- GEOTHERMAL RESOURCES
- OIL AND GAS
- SODIUM AND POTASSIUM *
- 94 HOT SPRING SHOWING WATER TEMPERATURE °F
- 83 WELL SHOWING WATER TEMPERATURE °F

# A SUMMARY OF MINERALL OCCURRENCES IN THE REGIONN OF THE LAKE MEAD NATIONAL. RECREATION AREA

G. Thomas Sorver, Jr., James P. Calkins, and Barry J. Solomon

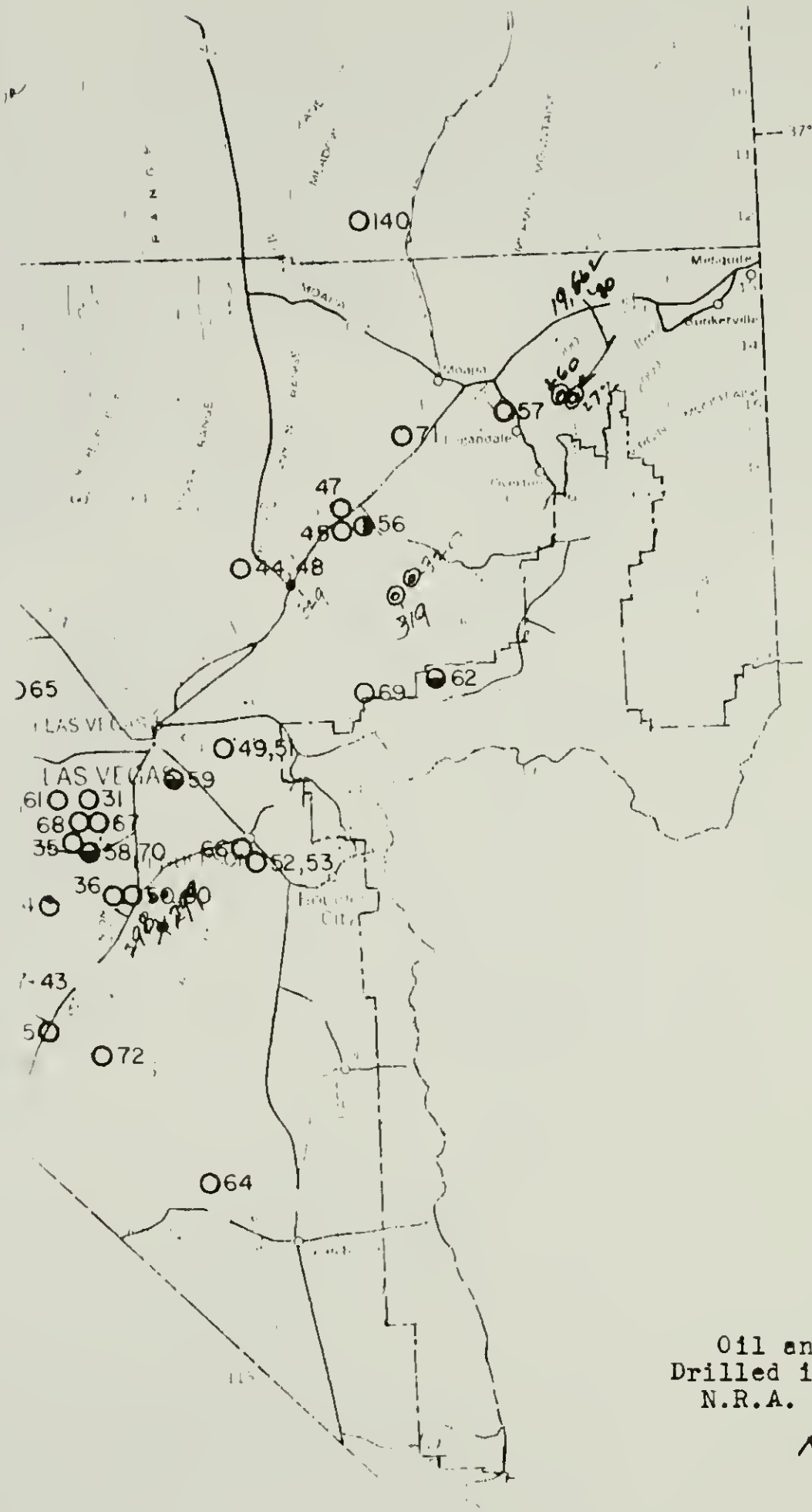
1980

GOVERNMENT USE ONLY

Map No. 2

### LOCATABLE MINERALS

| METALS | | NON-METALS | |
|---|---|---|---|
| ⊗ | ANTIMONY | Al | ALUNITE |
| ⊖ | ARSENIC | ▽ | BENTONITE AND CLAY |
| △ | BERYLLIUM* | ◐ | BORATES |
| ⊖ | BISMUTH* | St | BUILDING STONE* |
| △ | COLUMBIUM AND TANTALUM | D | DOLOMITE* |
| ♦ | COPPER* | Gr | GRAVEL |
| ◪ | GOLD* | ▱ | GYPSUM* |
| ⊗ | IRON | △ | KYANITE AND ANDALUSITE |
| ♦ | LEAD* | L | LIMESTONE |
| △ | MANGANESE* | M | MAGNESITE* |
| ● | MERCURY* | ⊠ | MICA |
| ♦ | MOLYBDENUM | N | NITRATE* |
| Ⓔ | RARE EARTHS* | Po | PERLITE* |
| ● | SELVER* | ◥ | QUARTZ CRYSTAL |
| ⊓ | THORIUM* | ⊡ | SILICA SAND* |
| ♦ | TUNGSTEN* | ⊕ | SODIUM CHLORIDE* |
| ⧖ | URANIUM* | ⊕ | SODIUM SULFATE* |
| ⧖ | VANADIUM* | V | VERMICULITE |
| ● | ZINC | Z | ZEOLITE* |




95. PAN AMERICAN PETROLE
13,116 ft.
96 PAN AMERICAN PETROLE
13,600 ft.
97. ATLANTIC INTERNATION
98. LAOO PETROLEUM CORP.
99. LAOO PETROLEUM CORP.
100. SHELL OIL COMPANY Gost

**ESMERALDA COUNTY**

101. CALIFORNIA EXCELSIOR
102. FISH LAKE MERGER OIL C
103. Coaldale Well, 1925, 5280 ft.
104. MONTE CRISTO OIL CORP.
105. NEVAOA OIL ANO MINER/

**EUREKA COUNTY**

106. EUREKA OIL ANO GAS CO
107. EUREKA OIL AND GAS CO
108. EUREKA OIL AND GAS CO
109. EUREKA OIL ANO GAS CO
110. EURKEA OIL AND GAS CO
111 EUREKA OIL AND GAS CO
112. EUREKA OIL AND GAS CO
113. LAST FRONTIER OIL CO. E
3549 ft.
114. JAMES EBERT & EOWARD
115. EUREKA OIL ANO GAS CO
116 SHELL OIL CO. Oamond Va
117. CHARLES BEYERBACH (Mt
1205 ft.
118. JACK TAYLOR Govt. No. 1,
119. JACK TAYLOR Govt. No. 2,
120. JACK TAYLOR Govt. No. 3,
121. W. F. ASH Damele Bros. No.
122. CARR & WRATH INC. Feder
123. GETTY OIL COMPANY Nost

**HUMBOLOT COUNTY**

124. BLACK ROCK OIL, GAS, RE
1921, 800 ft.

Oil and Gas Wells
Drilled in Clark County , Nev.
N.R.A. Boundery - Approx.

*Map No. 3*

CLARK COUNTY

260. MOBIL OIL CORP. Virgin River USA No. 1, 1,900', 1979.
(SE/4,SW/4,S9,T15S,R68E)

272. MOBIL OIL CORP. Virgin River USA No. 1-A, 19,562', 1980.
(SE/4,SW/4,S9,T15S,R68E)

298. FLEETWOOD OIL & GAS CORP. Fleetwood Federal Oler #1, 933', 1981
(SE/4,SE/4,S10,T23S,R61E)

299. FLEETWOOD OIL & GAS CORP. Fleetwood Federal Eva Garten #1, 2950', 1981.
(SW/4,SW/4,S11,T [illegible],R61E)

319. CHEVRON U.S.A., INC. Colorado Charity No. 1,
(SE/4, SW/4,SE/4,S22,T19S,R61E)

320. CHEVRON U.S.A., INC. Burlington Pocket U. 1,
(SE/4,NW/4,NE/4,S14,T15S,R61E)

329. GRACE PETROLEUM CORP. Arrow Canyon No. 1,
(NW/4,SW/4,S14,T13S,R63E)

30. MICHEL T. HALBOUTY Federal No. 1, 1976, 7060 ft.

**CLARK COUNTY**

31. E. W. BANNISTER No. 1, 1929, 522 ft.
32. COMMONWEALTH OIL CO. No. 1, 1933, 1897 ft.
33. L. M. HATFIELD No. 1, 1935, 707 ft.
34. RED STAR OIL CO. J. B. Nelson No. 1, 1943, 2210 ft.
35. RED STAR OIL CO. J. B. Nelson No. 2, 1943, 3767 ft.
36. NEVADA EXPLORATION CO. Porter No. 1, 1947, 2002 ft.
37. NEW HAVEN OIL CO. No. 1, 1947, 716 ft.
38. NEW HAVEN OIL CO. No. 2, 1947, 405 ft.
39. NEW HAVEN OIL CO. No. 3, 1947, 200 ft.
40. NEW HAVEN OIL CO. No. 4, 1947, 226 ft.
41. NEW HAVEN OIL CO. No. 5, 1947, 40 ft.
42. GOODSPRINGS OIL CO. No. 1, 1948(?), 370 ft.
43. NEW HAVEN OIL CO. No. 6, 1948, 130 ft.
44. UNITED PETROLEUM CORP. Apex No. 1, 1948, 1247 ft.
45. G & G EXPLORATION CO. No. 1, 1949, 1130 ft.
46. BLACK GOLD OIL AND GAS EXPLORATION CO. Golden Spike No. 1, 1950, 950 ft.
47. LAST CHANCE OIL CO. Crystal No. 1, 1950, 1002 ft.
48. SOUTHERN NEVADA OIL INVESTORS CO. Apex No. 1, 1950, 1455 ft.
49. McAULEY ASSOCIATES No. 1, 1952, 1970 ft.
50. BIG BASIN OIL CO. Govt. No. 1, 1953, 2000(?) ft.
51. McAULEY ASSOCIATES No. 2, 1953, 3000 ft.
52. LEONARD WILSON Govt. No. 1, 1953, 810 ft.
53. LEONARD WILSON Govt. No. 1A, 1953, 1466 ft.
54. INTERMOUNTAIN ASSOCIATES INC. (Arden Dome) No. 1 (No. 1X), 1954, 3293 ft.
55. INTERMOUNTAIN ASSOCIATES INC. (Jean) No. 1, 1954, 2273 ft.
56. SOUTHERN GREAT BASIN OIL & GAS INC. Govt. No. 1, 1954, 5085 ft. (redrilled as JOHN A. HAEBER Adam No. 1, 1973, 3496 ft.)
57. MOAPA NEVADA OIL & GAS CO. Logandale No. 1, 1955, 575 ft.
58. U. S. OIL CO. (MATADOR OIL CO.) Wilson No. 1X, 1955, 2020 ft.
59. JOE W. BROWN Wilson Govt. No. 1, 1956, 8508 ft.
60. W. T. SMITHDEAL JR. U. S. Lease No. 1, 1956, 300 ft.
61. BONANZA OIL CORP. Arden Dome No. 1 (Consolidated Govt. No. 1), 1959(?), 3260 ft. (redrilled as TIME PETROLEUM INC. Federal No. 31-1, 1971, 3260 ft.)
62. SHELL OIL CO. Bowl of Fire Unit No. 1, 1959, 5919 ft.
63. TRI-STATE OIL EXPLORATION CO. Miskell-Govt. No. 1, 1959, 2602 ft.
64. OSCAR BRAY No. 1, 1961(?), 840 ft.
65. C. J. LICHTENWALTER & C. M. TURPIN Turpin No. 1, 1961, 777 ft.
66. TRANS-WORLD OIL CO. (LEONARD WILSON) Houssels-Wilson-Milka No. 1, 1962, 2300 ft.
67. EQUALITY OIL CO. (ARDEN DOME OIL CO.) Chadek No. 1, 1964, 1627 ft.
68. JACK F. GRIMM (MINERALS DRILLING INC.) Wilson No. 1, 1965, 5686 ft.
69. ROSEN OIL CO. Muddy Dome (Federal) No. 1, 1965, 5666 ft.
70. KAMARDEN OIL & GAS LTD. KOG-1, 1969, 6755 ft.
71. C. P. PHELPS No. 1, 1970, 1625 ft.
72. SANDIA INTERNATIONAL METALS CORP. Duff No. 1, 1971, 438 ft.

**ELKO COUNTY**

73. BULL RUN OIL AND GAS CO. No. 1, 1922, 800 ft.
74. ELKO OIL DEVELOPMENT & IMPROVEMENT CO. No. 1, 1924, 3337 ft.
75. McCARTHY OIL CO. Rabas No. 1, 1950, 4125 (4422 ?) ft.

147. SHELL OIL CO
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155. SHELL OIL CO.
156. TEXOTA OIL C(
157. STEVE GOSE G(
LANDS INC. I
158. W. C. CO. No. 1,
159. WESTERN OIL L
160. PENNINGTON O
1505 ft.
161. TEXOTA OIL CO
162. TEXOTA OIL CO
163. TRANS WESTERI
No. 1, 1966, 44
164. WESTERN OIL L/
165. GULF OIL CORP.
166. GULF OIL CORP.
167. GULF OIL CORP.
168. GULF OIL CORP.
169. GULF OIL CORP.
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174. GULF OIL CORP.
175. GULF OIL CORP.
176. GULF OIL CORP. F
177. GULF OIL CORP. S
178. PAN AMERICAN PE
1968, 8355 ft.
179. PAN AMERICAN PE
No. 1, 1968, 294
180. WM. N. PENNINGTC
American Big Was
181. TEXOTA OIL CO. E.
182. WESTERN OIL LAN
183. TENNECO OIL CO.
184. A. PAUL SUTHERL/
185. TENNECO OIL CO.
186. NORTHWEST EXPL(
9040 ft.
187. NORTHWEST EXPL(
1976
188. NORTHWEST EXPLC
10,473 ft.

E. EAGLE SPRINGS FIE
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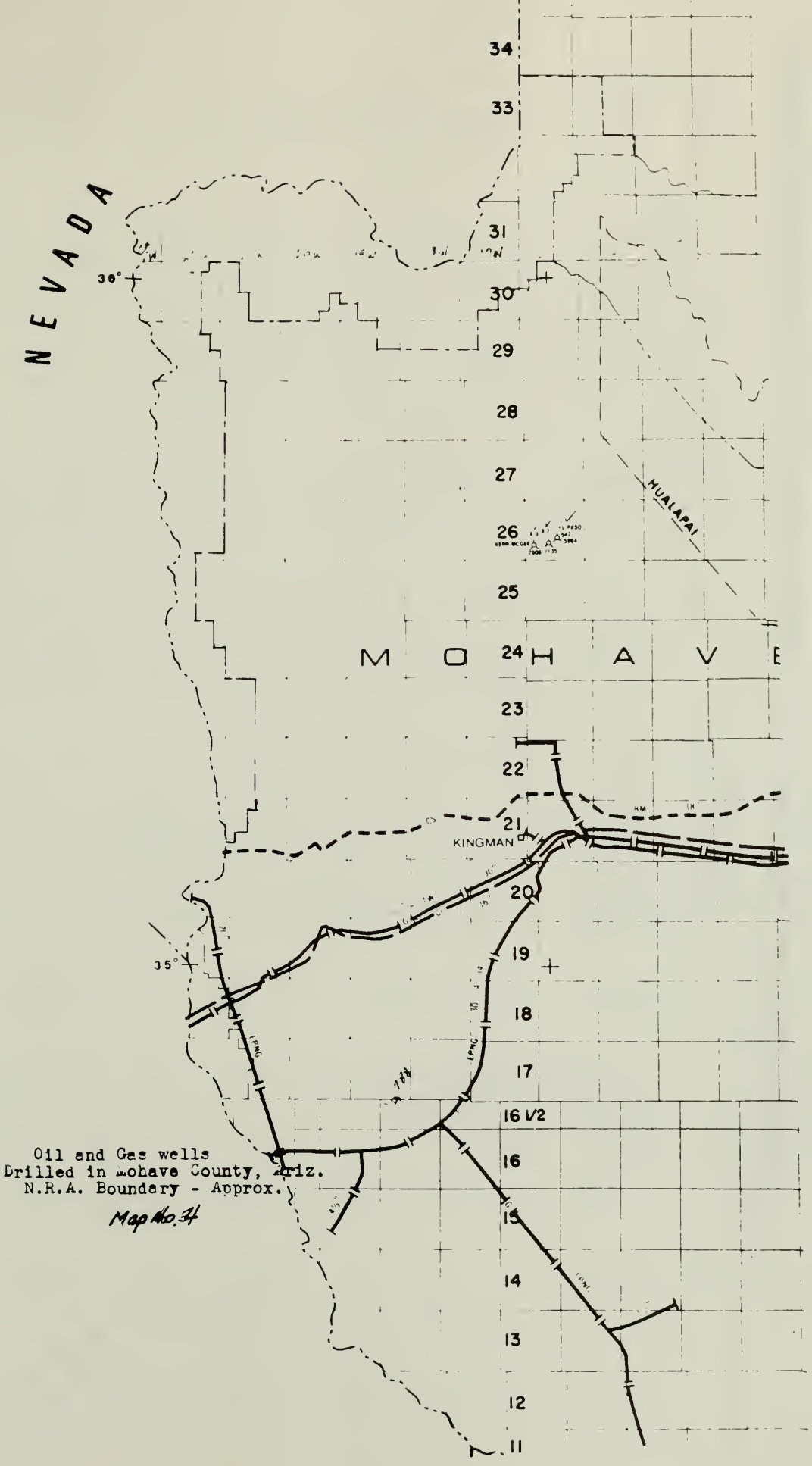
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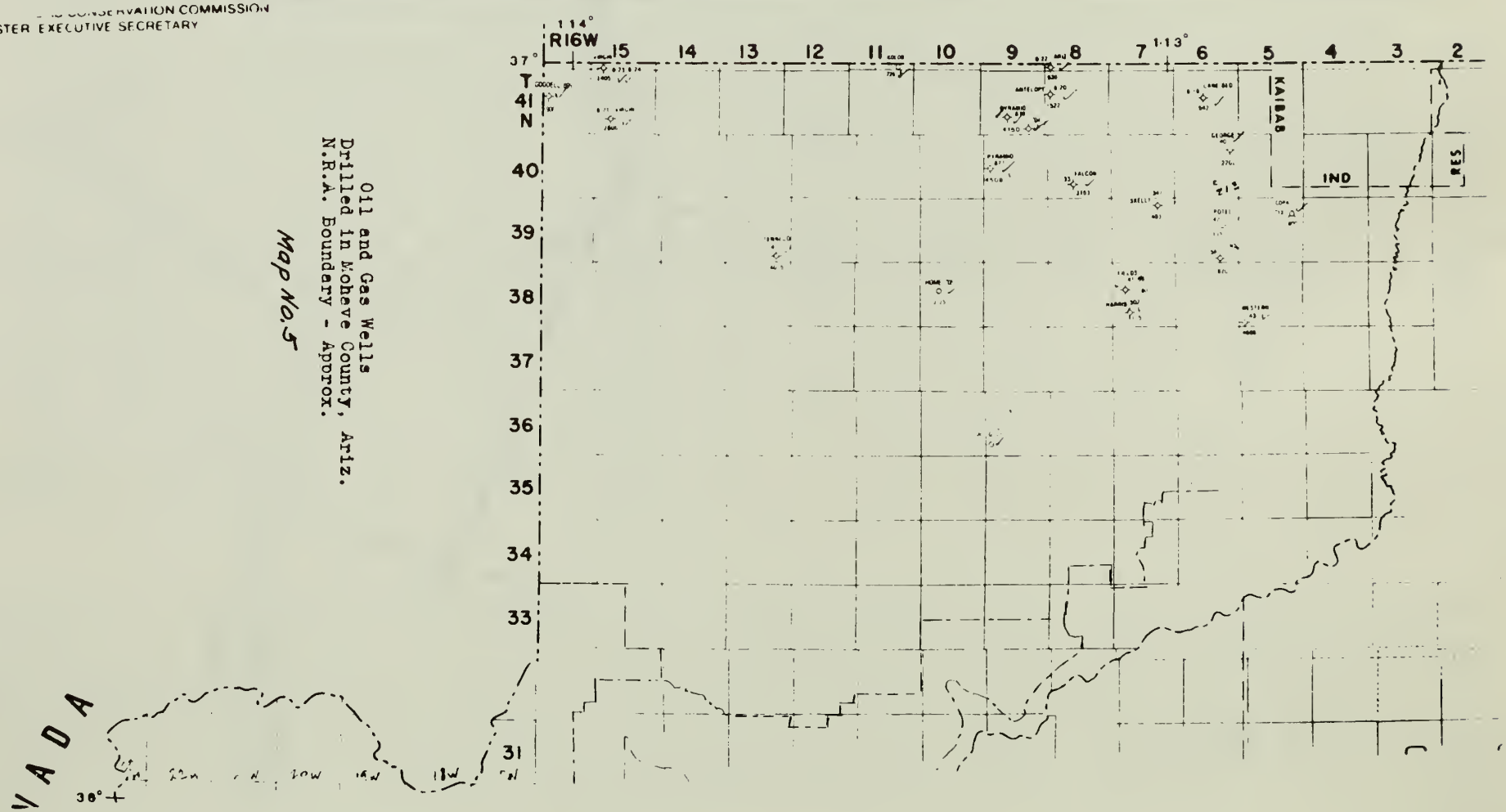
HUALAPAI
M O H A V E
KINGMAN
EPNG
EPNG
Oil and Gas wells
Drilled in Mohave County, Ariz.
N.R.A. Boundary - Approx.
Map No. 34

...S CONSERVATION COMMISSION
JOHN BANNISTER EXECUTIVE SECRETARY

Oil and Gas Wells
Drilled in Mohave County, Ariz.
N.R.A. Boundary - Approx.

Map No. 5



CHISE COUNTY

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 14 | 20S-20E-16 NE NE | Phillips Huachuca Al State (strat) | 4261 GL | 6/82 | D | 8513 | Confider |
| 16 | 20S-23E-14 SW SW | Phillips Tombstone Al State | 4790 KB | 9/81 | D | 10561 | |
| 93 | 23S-29E-14 NW NW | Phillips Douglas Al State (strat) | 4295 GL | 6/82 | D | 7058 | Confider |
| 4 | 23S-30E- 8 NE SW | Union Oil 80-1 State (geothermal) | 4210 GL | 11/80 | | 715 | Confider |

COCONINO COUNTY

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| - | 41N- 1W-24 SE NE | Shields Exploration 8-24 Fed (strat) | 5040 GL | | L | | |
| 2 | -24 NE SW | J. M. Shields 4-24 Federal (strat) | 5043 GL | | | 750 | |
| - | -24 NE SW | J. M. Shields 5-24 Federal (strat) | 5037 GL | | | 4 | |
| 5 | -24 NW SE | J. M. Shields 1-24 Federal (strat) | 5062 GL | 1/82 | | 482 | Confider |
| 0 | -24 NW SE | J. M. Shields Travis 1-24 Federal | 5068 GL | | | 900 | |
| 1 | -24 NW SE | J. M. Shields 2-24 Federal (strat) | 5072 GL | | | 50 | |
| 5 | -24 NW SE | J. M. Shields 6A-24 Federal (strat) | 5066 GL | | | 491 | |

GILA COUNTY

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5 | 9S-26E-16 NW NE | Phillips Safford Al State (strat) | 3562 GL | 4/82 | | 8509 | Confiden |

e attached list of 8 heat flow test wells, Bureau of Geology & Mineral Technology

MARICOPA COUNTY

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5 | 2N- 7W-27 SW SW | Gemini Oil, Gas & Mineral 1 Heisler | 1130 GL | 10/81 | D | 2040 | |
| 3 | 5N- 3W-28 SE SE | Tri Oil 78-28 State | 1613 GL | | A | | |
| 3 | -34 SW NW | Salt River Basin Fletcher 1 Federal | 1600 GL | 10/81 | D | 3980 | |

e attached list of Phillips Petroleum temperature gradient wells

MOHAVE COUNTY

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 78 | 16½N-19W-20 SW NE | O'Brien Resources AZ-1 (geothermal) | 1600 GL | 12/81 | | 325 | |
| 706 | 36N- 9W-30 NE SW | Gulf Oil 1 Federal | 6350 KB | 11/80 | D | 5961 | Precambr |
| 705 | 38N-10W-17 SW NE | Home Petroleum 17-1A Federal | 4565 GL | 6/80 | D | 3125 | Pennsylv |
| 813 | 40N- 6W-26 NW NW | Brooks Exploration 1-26 Federal | 5070 GL | | A | | |
| 676 | 41N- 9W-28 NW SE | Pyramid Oil 1 Federal | 4743 KB | 12/77 | D | 4150 | Mississi |
| 704 | -33 NW NW | Pyramid Oil Rock Creek 2 Federal | 5009 KB | 4/81 | W | 3530 | |
| 726 | 42N-11W-35 SE NW | Kolob Petroleum 35-1 Federal | 2890 GL | 3/82 | D | 1432 | |

NAVAJO COUNTY

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2 | 9N-22E-35 SE NE | Gail W. Sponseller 1 Sponseller | 6500 GL | | L | | |
| 4 | -36 NE SE | Gail W. Sponseller Lakeside Al Fed | 6500 GL | | L | | |

PIMA COUNTY

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9 | 15S-14E- 4 SE NW | Decker Properties 1 Decker (geotherm) | | | L | | Confiden |
| 7 | 17S- 8E-36 NW SE | Phillips Redondo Al State (strat) | 3278 KB | 3/82 | D | 9021 | Confiden |
| 5 | 17S-15E-10 SW NE | Phillips Mtn View Al State (strat) | 3141 GL | 7/82 | D | 8333 | Confiden |
| 9 | 12S- 6W- 9 SE NE | NANO'LTEX JPAZA 1 Federal | 1680 GL | 12/80 | D | 1044 | Volcanic |

e attached list of Phillips Petroleum temperature gradient wells

PINAL COUNTY

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2 | 7S-10E- 2 NW SE | Anschutz Texoma 1-10-2 State (Phillips Petroleum 1 State-A) | 2044 KB | 1/81 | D | 18013 | Precambr |

SANTA CRUZ COUNTY

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5 | 14N- 6W-32 SE SE | Phillips Kirkland Al State (strat) | 3628 GL | | A | | Confiden |

YAVAPAI COUNTY

e attached lists of Phillips Petroleum temperature gradient wells

# APPENDIX H: FLOOD MITIGATION COMPLIANCE

Executive Order 11988 was developed "in order to avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative" (EO 11988; 42 FR 26951).

National Park Service "Floodplain Management and Wetland Protection Guidelines" ( Federal Register vol. 45, no. 104, May 28, 1980) list procedures for complying with the executive order. These procedures require identification of floodplain, flood-hazard, and wetland areas potentially subject to public use and/or development, where the magnitude of hazard and impact of human activities is likely to be greatest; determination if the proposed action is in, or could affect, a floodplain or wetland; public review; identification and evaluation of practicable alternatives to locating in the base floodplain or wetland; identification of impacts; minimization of impacts; restoration, preservation, and enhancement of floodplain values; and findings and public explanation.

In preparation for development of the Draft General Management Plan, 100-year floodplains, probable maximum floodplains, flood-hazard areas, and wetlands within Lake Mead National Recreation Area were identified. Input was obtained from the public in the development of alternatives and determination of impact topics. For each alternative of the plan, the facilities that would remain in the floodplain and flood-hazard areas are shown in chart form in the document. Estimates are provided for numbers of people expected to be in the floodplain. The alternatives include those that would remove development in some areas from the floodplain. (Alternatives that were considered and rejected are listed in appendix F.) Impacts on natural and beneficial floodplain values are not discussed in the DEIS because the flash-flood areas at Lake Mead do not contain the elements normally associated with floodplains such as wetlands, groundwater recharge areas, and diverse riparian ecological communities; the flash floodplains at Lake Mead NRA have already been disrupted by their use as developed areas; protecting life and property already in the floodplain was judged to be a higher priority than restoring the natural qualities of the flash floodplain which are the very qualities that endanger life and property; and Lake Mead has been set aside as a recreation area with access to the lakes a primary service. Some tradeoffs in the area of natural values are necessary to provide this access. Although impacts on natural and beneficial values of floodplains are not assessed in the DEIS, the planning team has located no new developed areas in flash-flood areas. Therefore, the plan already exhibits compliance with most of the requirements of the executive order and implementing guidelines. All that remains to be done to complete the compliance process is public review of the DEIS and development and approval of a statement of findings. The statement of findings will be included in the final environmental impact statement.

The steps required for public review are as follows: Treat the issue in an environmental document that complies with public involvement requirements of CEQ; provide public notice to individuals and groups

affected by, or with a direct interest in, the proposed action and allow them to assist in development of alternatives; circulate NEPA and decision documents to at least the following: Environmental Protection Agency, Federal Emergency Management Agency, U.S. Fish and Wildlife Service, U.S. Geological Survey, Water and Power Resources Service (Bureau of Reclamation), U.S. Army Corps of Engineers, U.S. Soil Conservation Service, state and area clearinghouses, coastal or river basin commissions, and state coastal zone management administrations as appropriate; make the DEIS available for public and agency comment for a minimum of 60 days from the date it is filed with the EPA; indicate in the Federal Register notice of availability and on the cover sheet of the EIS that the DEIS is also to serve as a compliance instrument for the orders; and include above agencies in distribution of DEIS.

The first two of these requirements were met before publication of this document. The remaining requirements for public review are being fulfilled in the process of publishing, distributing, and considering comments on this DEIS.

# BIBLIOGRAPHY


ARIZONA BUREAU OF MINES

1969 Mineral and Water Resources of Arizona. Prepared in conjunction with the U.S. Geological Survey and U.S. Bureau of Reclamation. Bulletin 180.

ARIZONA STATE OIL AND GAS CONSERVATION COMMISSION

1977 "Well Location Map Four." Prepared by J.R. Conley and O.A. Stacey (Revised 1981).

DEACON, JAMES E.

1977 Lake Mead Monitoring Program. Prepared for Clark County Sanitation District No. 1. Las Vegas: University of Nevada.

FLOOD LOSS REDUCTION ASSOCIATES

1982 "Preliminary Evaluation of Nonstructural Flood Loss Reduction Measures - Lake Mead NRA." Report for National Park Service.

1983 "Flood Mitigation Alternatives for Temple Bar, Cottonwood Cove, and Katherine Landing - Lake Mead NRA." Report for National Park Service.

NEVADA BUREAU OF MINES AND GEOLOGY

1965 Geology and Mineral Deposits of Clark County, Nevada, by C.R. Longwell, E.H. Pampeyan, Ben Bowyer, and R.J. Roberts. Bulletin No. 62.

1977 "Wells Drilled for Oil and Gas in Nevada through 1976," by Jarry J. Garside and John H. Schilling. Map No. 56.

_____, 1982, Lists of Wells Drilled for Oil and Gas (update to map 56).

NORTHERN ARIZONA COUNCIL OF GOVERNMENT, PLANNING AND DEVELOPMENT DIVISION

1982 "Arizona Clean Lake Classification Study - Final Report," by William L Towler.

O'BRIEN, ROBERT D.

1982 "An Evaluation of Mineral Resources, Lake Mead NRA, Arizona and Nevada." Under contract to Department of the Interior, National Park Service, Contract #PX8000 2 0506.

SERVER, THOMAS G. JR., JAMES P. CALZIA, AND BARRY SOLOMON

1980 "A Summary of Mineral Occurrences in the Region of the Lake Mead National Recreation Area." Pre-publication copy for government use only.

SWAPP, CLOYD W.
1961 The Geology and Gas and Oil Possibilities of Northwestern Arizona. Arizona Board for the Arizona Oil and Gas Conservation Commission.

U.S. DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY
1979 Potential Hazards from Floodflows and Debris Movement in the Furnace Creek Area, Death Valley National Monument, California-Nevada. Open-file report 79-991. John Crippen, Menlo Park, CA.

U.S. DEPARTMENT OF THE INTERIOR, NATIONAL PARK SERVICE
1974 Lower Colorado River Land Selection Program. Report by Intra-Agency Field Task Force, Phoenix, Arizona.

1979 Carrying Capacity Study: Lake Mead National Recreation Area. Denver Service Center. Denver, Colorado.

1979 "Threatened and Endangered Plants of Lake Mead National Recreation Area - A Report on Candidate Species," by James S. Holland and Dennis Shramm. Denver Service Center, Denver, Colorado.

1980a Historic Resources Study: Lake Mead National Recreation Area, by Mike Belshaw. Denver Service Center, Denver, Colorado.

1980b Land Acquisition Plan: Lake Mead National Recreation Area. Lake Mead National Recreation Area, Boulder City, Nevada.

1980c Mines and Mining Districts in the Lake Mead National Recreation Area: Supplement to the Lake Mead National Recreation Area Historic Resources Study, by Mike Belshaw. Denver Service Center, Denver, Colorado.

1980d The Archeology of Lake Mead National Recreation Area: An Assessment," by Carole McClellen, David Phillips, and Mike Belshaw. Western Archeological and Conservation Center, Publications in Anthropology, No. 9. Tucson, Arizona.

1981a "Natural Resources Management Program: An Addendum to the Natural Resources Management Plan." Western Regional Office. San Francisco, California.

1981b "Statement for Management: Lake Mead National Recreation Area." Western Regional Office. San Francisco, California.

1982a "Lake Mead National Recreation Area: Visitor Survey Analysis." Denver Service Center, Branch of Concessions Management. Denver, Colorado.

1982b "Lake Mead--Indian Relationships Consultations: A Preliminary Report," by John G. Herron. Denver Service Center, Denver, Colorado.

1982c "Flood Hazard Studies--Katherine, Cottonwood Cove, Willow Beach, Boulder Beach, Las Vegas Wash, Overton Beach, Temple Bar, and Other Minor Washes." Included analysis of 100-year and probable maximum floodplains and alternative designs of structural flood mitigation measures.

1983 "Historic Sites Within Lake Mead National Recreation Area Deemed Ineligible for National Register Nomination," by Nick Scrattish. Denver Service Center, Denver, Colorado.

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